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The Railway and Locomotive Historical Society,
INC.

Biographies should serve as an inspiration for the youth of America. In no other country in the world have the opportunities for advancement through one's own efforts been so great. The soil of the great west produces crops, the environment produces men! Bion J. Arnold grew up with the west. He believed in it and he saw it become great. I'm sure that all of your members will be interested in reading the tribute paid him by his friend, Mr. Yungmeyer and that they will be sorry to learn that our Society has lost another staunch supporter.

How many of us recall before the days of the automobile and the open trolley, the railroads that served the amusement parks? Probably the most famous in the vicinity of Boston was the little narrow gauge—the Boston, Revere Beach & Lynn R. R. Mr. Boutell has furnished an interesting contribution on the Chesapeake Beach Ry., a road serving Washington in somewhat the same fashion. Gone are these little railroads now, much to our regret.

A few years ago many of our railroads were experimenting with the three cylindered locomotive. Turn back to your Bulletin #21 and you will find that the Philadelphia, Wilmington & Baltimore R. R. had two such locomotives as listed on their roster of 1855. A few years ago our member, Mr. Paul T. Warner presented a very interesting paper on this

subject before our New York Chapter that is printed herewith. That these engines had their faults, we all admit, but the idea was worth a trial as his paper amply indicates.

In his contribution on the Spettel pontoon bridge Mr. Miller has attempted to place credit for the idea where it properly belongs. Many an inventor has found that some or one of his friends have visited our Patent Office before him.

Your Editor has tried briefly to give you an idea of the number and extent of the different firms that have built locomotives in this country. Ample opportunity is afforded for further research work along these lines. With some of these builders only their name remains, others are better known. One after the other faded out of the picture until only three large companies and a few smaller ones remain.

Lastly, despite the conditions caused by the war, the Society will carry on as best they are able. Your publications may be a bit behind schedule, they may not have as many pages as in the past and the cuts may not be as clear and may even disappear entirely. The past winter has been difficult owing to sickness, extra work added to the duties already performed by your officers but we shall make every effort to carry on.

Pennsylvania R. R. Class D-16

One of our members, Mr. Norman J. Perrin, with the assistance of others, published a very interesting leaflet in which he has listed chronologically the locomotives of this class. The specifications of 1916 and 1925 are furnished together with a brief description of this class and the various sub-classes. This is followed by the construction date of each locomotive of each class, together with the renumbering of the individual locomotives from 1895 to 1910, when CA&C #957, the last one was built. The leaflet is titled as Number One in a P. R. R. classification series. Whether any more will be issued depends upon the reception accorded the first one by our members. A limited supply for our members has been purchased by the Society and copies can be procured for 20c each, two dimes, from Chas. E. Fisher, Editor, 20 Wilde Road, Waban, Mass.

Cover Design

It seems only yesterday that those handsome Buchanan locomotives were handling the fast trains of the New York Central across the Empire State. Whether they had 70″ drivers or larger, they did a good job. On the freight trains the low wheeled "mogul" had crowded out the eight wheeler.

Trains grow in weight. The New York Central was rapidly becoming the preferred route between New York and Chicago and this

business called for more trains and more cars per train. The Buchanan eight wheelers gave way to the Atlantics, not a particularly handsome locomotive but the firebox over the trailer furnished a better steaming capacity. More wheels pull more freight and in the same way the "mogul" was replaced by the "consolidation."

Still the business grew! The slippery Atlantics were replaced by a flock of Pacifics. The first were rather "chunky" affairs but the K-3 classes with their clearcut lines were a handsome job. For over a decade these engines handled the best trains and handled them well. Boiler horse power calls for larger fireboxes and thus the "Hudson" was evolved. These are the mainstay of the N. Y. C. passenger power. Designed to meet their requirements, they have done all of that and more, they are a handsome, sturdy-looking locomotive.

The "consols" gave way to the "mikes," in fact some of them were rebuilt into this type and about this time the "mountain" or "Mohawk" as it is called on the New York Central was introduced. Each class has carried certain improvements and refinements and the L-3 group are quite in keeping with their sister "Hudsons." In fact a certain number of engines in the last group have had their frames made capable of using a larger pair of drivers, when and if needed for passenger service.

Mr. Barr, our artist, has furnished us with a cover design showing one of these locomotives intended for freight service. The handsome Buchanans, the stubby Atlantics and "consols." have all gone and some of the other classes are going "west" but in their places the "Hudsons" and "Mohawks" still carry on, combining good looks with good design.

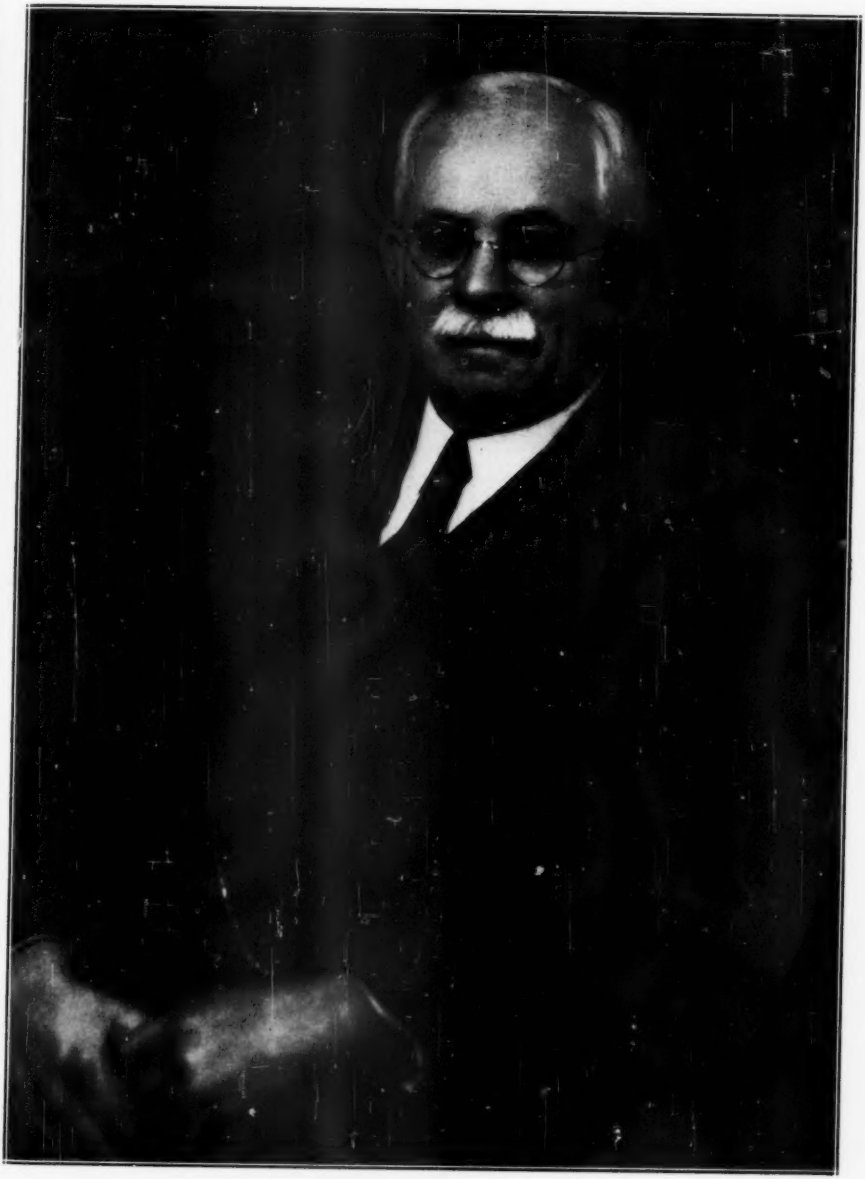
Bion Joseph Arnold

1861 - 1942

By D. W. Yungmeyer

Bion Joseph Arnold, electrical engineer and inventor, was born at Casnovia, about fifteen miles north of Grand Rapids, Michigan, August 14, 1861. Descended from four generations of pioneers from England, Scotland, Wales and Ireland, he was the son of Joseph (lawyer) and Geraldine Reynolds (teacher) Arnold. A frail youth, the decision of his parents to leave Michigan, in 1865, and take up homestead rights on Callahan Creek near Ashland, Nebraska, proved fortunate for the boy, for there the advantages of a new country and an understanding home atmosphere developed in him an iron constitution which served him well during his long and busy life. He entered the public schools of Ashland in 1870, continuing until 1879, in which year he entered the University of Nebraska, leaving that institution in 1880. His college degrees were: B. S., Hillsdale College, Michigan, 1884; M. S., 1887; post graduate course in Electrical Engineering, Cornell University, 1888-89; E. E., University of Nebraska, 1897; Honorary M. Ph., Hillsdale College, 1889; Honorary diploma for "Distinguished Achievement in Invention and Engineering," Hillsdale, 1893; Honorary Doctor of Science, Armour Institute of Technology, 1907; and Honorary Doctor of Engineering, University of Nebraska, 1911.

The young Arnold early gave promise of great mechanical ability, constructing models of farm implements before he was 8; a small steam engine at 13; a larger engine at 14; a complete 1/8th horse-power steam plant at 15; a full-sized bicycle at 17; and a working model of a standard "American Type" steam locomotive, 1/16th full-size, complete in all its details at 18. There are no particulars available of the farm implement models, nor of the engine built at 13, but of the larger engine built in his 14th year it is known that he used for the boiler a 4-inch pipe coupling discarded by the Burlington & Missouri River Railroad in 1870 when the road laid the pipe line to the water-tank at Ashland. An old lynch-pin wagon wheel hub-band, discarded by some freighter crossing the plains to Denver, was used as a fire-box, an abandoned valve wheel for a fly-wheel, and a gas cock, picked up by someone in Omaha and given to the boy, served as a throttle valve. The main bearings, cylinder supporting bracket, the crank-disc, the connecting rod and piston rod guide were made of brass castings, and the cylinder and steam chest were cast from Babbitt's metal. As he had been unable, up to the time of building this engine, to find anyone who could tell him anything about foundry work, he whittled out the patterns and made the castings in plaster of Paris moulds as best he could. The engine, which was about fifteen inches high, was fitted with link motion for reversing and, although the entire machine was crudely constructed and fitted together with improvised bolts and other fittings, it operated successfully and is still in existence.



BION JOSEPH ARNOLD

In describing the bicycle built when Arnold was 17, the *Sunday State Journal* of Lincoln, Nebraska, May 19, 1907, says: "During these eventful school years at Ashland, in addition to acquiring experience in operating an engine, the boy turned out in rapid succession numerous boats, scroll saws, models of steam engines, and, as a climax built in his seventeenth year without ever having seen one, the first bicycle in the state, having as a guide nothing but an advertising cut three-quarters of an inch high, which was being run by the Pope Company in the *Youth's Companion*. He, however, originated, in so far as he was concerned, the suspension type of wheel now so common in bicycle construction, and, in fact, then used by the manufacturers of bicycles, and built his wheels accordingly. Not only did he design and build the machine but, further, he accomplished what his father and friends thought impossible, namely: he learned to ride it." No rubber tires were used as these were then beyond his means. The tire of the front wheel (the machine was, of course, of the big wheel-little wheel type), which was 44 inches in diameter, was lined with a wooden fellowe to stiffen it. The machine complete weighed eighty pounds.

Of the ⅛th horse-power steam plant the above quoted paper says further that "at 15 he had sent to a model maker's supply house in Boston, advertised in the *Youth's Companion*, for four iron rods, each one foot long and threaded their entire length. With these as uprights, and a supply of nuts threaded to fit and with castings he made out of Babbitt's metal, he constructed a vertical steam engine of about ⅛th horse power and supplied it with steam from a crudely constructed sheet iron boiler with wooden heads. This boiler he supplied with water from an old kerosene barrel, elevated a sufficient distance above the boiler to force water into it when the steam pressure was low. In the construction of this engine he devised and used a piston valve now in common use on locomotives and other engines, believing himself to be its inventor, only to soon find, after a visit to the railway shops at Plattsmouth, that it had been invented long before he was born and was then in use on the steam engine driving the railroad shops." Nothing remains of this steam plant except a drawing made from memory thirty years after the engine was built.

The model locomotive is a perfect working engine in all particulars, including cross-head pump and injector for supplying water to the boiler, cylinder cocks, pet cock and lazy cock for pump, steam gauge, two pop or safety valves, whistle, three water gauge cocks, blow-off cock, blower, Stephenson link motion with reverse lever, throttle valve and lever. It can be run by steam or compressed air and when running by steam utilizes charcoal for fuel. It was built in 1880 in a new country by an eighteen-year old boy without mechanical training or instruction and from such crude materials as he was able to gather in a small western town devoid of machine shops and skilled mechanics, and with but one book, written for locomotive runners, entitled "Forney's Catechism of the Locomotive" constituting his sole technical library.

The engine is built to a scale of three-fourths of an inch to the foot, or one-sixteenth full-size, from dimensions taken from Burlington

& Missouri River Railroad engine No. 31 which ran between Plattsmouth and Lincoln, Nebraska, in 1879-1880. Colonel Arnold told in his later years, with great enjoyment, of the many times he used to meet the train at Lincoln for the purpose of taking measurements of the different parts of the locomotive, the engineer coming down from the cab to sit on the platform and give instructions to him. He made no drawings as he then had no idea of how to go about the process, but his notes were copious, and it was from the latter alone that the locomotive was finally completed. To see this model today, realizing the difficulties of its construction, is to stand in awe before the work of the boy, untutored in the arts of metal-working, with but one book and one friend to guide him.

The boiler and tank were built in a tin shop at Lincoln while Arnold was attending the University of Nebraska in the fall of 1879, and the machinery made in a blacksmith shop at Ashland during the summer of 1880 where the use of a forge, a drill press and a large lathe was given him. Not having access to a foundry, he made all the castings of brass mixed by himself and cast them in sand dug from a local pit or in plaster of Paris moulds of his own devising. The only parts of the locomotive, as it is today, that he did not make are the four cylinder cocks, the three water gauge cocks and the two cage valves for the pump, which were made for him by a local jeweler, the name plates and the two oil cups on the steam chests, the blow-off cock, and a few small bolts for the main rods and guides, the greater part of which he purchased from a mail-order model house in Boston, and the bell, the latter being one of the souvenir bells cast from the metal of the old Chicago Court House Bell which was destroyed in the great Chicago Fire of 1871. He originally made all of these parts but later discarded them for the purchased parts in order to improve the appearance of the locomotive.

The construction of this locomotive was the turning point in Arnold's education. His parents had hopes that he would follow the course they so earnestly desired, but the talks the father had with the boy while the locomotive was taking shape finally convinced him that only harm would come by forcing the continuation of the studies he had been pursuing, and that such a course would only delay the hour when young Arnold would make his own decision. Reluctantly the parents gave their consent to another school and thus was made certain the development of the mind which left convincing proof that the change was for the best.

In 1884-86 Mr. Arnold served as traveling expert and general agent for traction engine companies; 1886-87 as draughtsman, engineering department, The Edward P. Allis Co. (now Allis-Chalmers Co.); 1887-88 as chief designer, Iowa Iron Works Co., Dubuque, Iowa; 1888-89 as mechanical engineer, the Chicago Great Western Railway; 1889-93 as consulting engineer, General Electric Co., Chicago Office; and as independent consulting engineer 1893 to date of beginning active service in the Army in December, 1917. Retiring from active service after the World War as Colonel Auxiliary Reserve Corps, United States Army, he resumed his consulting practice.

The list of Mr. Arnold's works is an imposing one. The pioneering spirit evidenced so early in his life never slackened, but growing as he grew carried him far in his chosen profession. In 1893 he designed and built the Intramural Electric Railway, World's Columbian Exposition, (Chicago), the first commercial installation of the third rail system on a large scale. He then went on to become consulting engineer for numerous steam and electric railways, including the designing and assuming the engineering and financial risks of the pioneer installation of the Chicago & Milwaukee Electric Railway (now the Chicago, North Shore & Milwaukee), the first commercial installation of the present a.c.-d.c. system of which the New York Central, the Chicago, Milwaukee, St. Paul & Pacific, and the Illinois Central Railroads are the outstanding examples. In the pioneer installation of the Lansing, St. Johns & St. Louis Railway, in Michigan, in 1900, he developed a single-phase alternating system of his own, the first single-phase railway to be operated. In 1907 he converted the St. Clair tunnel of the Grand Trunk Railway between Port Huron, Michigan, and Sarnia, Ontario, Canada, from steam to electric operation, adopting for the first time the single-phase, high tension system for heavy electric railway work.

From 1900 to 1909 he was also consulting engineer for the Chicago Board of Trade; the Chicago, Burlington & Quincy, Grand Trunk, New York Central and Erie Railroads; was during this period the first independent engineer retained to advise as to the feasibility of and to help devise the plan for electrifying the Grand Central Terminal in New York in 1901 and was a member (1901-05) of the Electric Traction Commission, which carried out the work, involving the electrical equipment of some 300 miles of track. He was a member and Chairman (1905) of the Valuation Commission which valued the properties of the Chicago Street Railway Companies, and of subsequent traction valuation commissions of that city. 1905 to 1907 found him as Consulting Engineer of the Wisconsin State Railway Commission, a part of this time (1906-07) shared as a member of the Electric Traction Commission of the Erie Railroad, the while acting as Consulting Engineer (1902-06) for the City of Chicago in the matter of revising street railway systems. He was Chairman and Chief Engineer, 1907-11, and Chairman, 1907 until the time of his death, of the Board of Supervising Engineers, Chicago Traction, for the reconstruction and extension of the system now aggregating over 1,100 miles of track and more than 3500 cars.

The Public Service Commission, 1st District, State of New York, had the benefit of his services (1908-11) in matters connected with subways, street and elevated railway properties in New York and Brooklyn, his recommendations, which were generally carried out, resulting in additional side doors in the subway cars, improvement of the signal system (speed control feature) and platform arrangements whereby a large increase in the carrying capacity and earnings of the Interborough and changes in the design of subsequent subways (larger bores and better ventilation) were effected. During this time he also acted as Director of Appraisals for the same commission in valuing the street and elevated properties of New York and Brooklyn.

The years 1911 to 1913 saw him as Chief Subway Engineer of the City of Chicago, and Consulting Engineer on traction matters for the cities of Pittsburgh, Providence, Los Angeles, San Francisco, Toronto and Cincinnati. During this period he also appraised the properties of the Seattle Electric Company, the Puget Sound Electric Railway Company, the Southern California Edison Company (Los Angeles), the Metropolitan Street Railway System of Kansas City and the Toronto Street Railway.

In 1913 he was chosen by the Citizens' Terminal Plan Committee of Chicago to review plans submitted by the Pennsylvania Railroad, and others, for passenger terminals, and to recommend a comprehensive system of steam railway terminals for the city. His recommendations were largely followed resulting in the creating by the City Council of the Chicago Railway Terminal Commission to co-ordinate the work, and in his appointment and continuance as a member of it until he resigned to enter the Army in 1917. During this four-year period he also accepted commissions from the Government, the railroad companies, civil and commercial bodies, and the governing bodies of the cities of Boston, Providence, New York, Jersey City, Philadelphia, Baltimore, New Orleans, Los Angeles, San Francisco, Sacramento, Seattle, Winnipeg, Minneapolis, Des Moines, Denver, Kansas City, Chicago, Cincinnati, Flint, Detroit, Toronto, Buffalo, Harrisburg, Rochester, Syracuse and others to advise regarding steam or electric railway matters.

In 1916 he was retained by the Public Service Commission of Massachusetts to review and prepare reports upon certain valuations and operating costs of the Bay State Railway Company, comprising the interurban and city street railway properties of about fifty of the cities and towns surrounding Boston, his recommendations again being generally carried out. In 1916-17 he was a member of the Chicago Traction and Subway Commission, engaged by that city to value and co-ordinate all the surface and elevated railways of Chicago with a subway system, and to formulate a method of operating and financing the system. His report formed the base upon which all plans since drawn have rested. During this time he was retained as Chairman of a Board of Advisory Engineers to the City of New Orleans to determine the feasibility of crossing the Mississippi River by means of a bridge or tunnel for carrying the steam railways entering that city from the west, and for co-ordinating the various steam railways and the Belt Line Railway into a comprehensive terminal system.

Mr. Arnold was in Europe with the Chicago Railway Terminal Commission at the time the World War began and witnessed the partial mobilization of the French, British and Belgian armies. Returning to the United States he gave up all his civilian work and on January 23, 1917, was commissioned Major of Engineer Reserve Corps. Among his first duties was the naming at the request of the Chief of the Engineer Corps over one hundred civilian engineers, practically all of whom were among the first to be commissioned in the Engineer Reserve Corps. In October, 1917, he applied for active service and was then asked by the

Chief Signal Officer to transfer to the Air Service with the understanding that he would soon go overseas with the first aero squadron. On December 14, 1917, he was transferred to the Regular Army with rank of Lieutenant Colonel, Aviation Section, accepting this commission ten days later. The situation of aircraft production being acute, on his arrival in Washington he was temporarily assigned to the Equipment Division, Production Section, at Washington. He made two complete surveys of air-craft production conditions, one for the Equipment Division and one for the Secretary of War; the latter being with the Snowdon-Marshall Investigating Commission. During the month of March, 1918, he was temporarily assigned to the Navy Department and made a complete survey of air-craft production conditions for the Navy, reporting, on March 28, 1918, to the Chief of Construction.

Re-assigned to the Equipment Division of the Army he made, at the request of the Secretary of War to the Director of the Bureau of Aircraft Production, a complete investigation and exhaustive analysis of the aluminum production and consumption conditions in the United States and allied countries; the object being to answer the question for the Council of National Defense as to whether the United States would be able to supply itself and its allies with sufficient aluminum to continue the prosecution of the war. This important and vital analysis also covered seven collateral questions relating to the methods of utilizing pure aluminum in the production of war equipment, and necessitated a personal investigation of the bauxite mines, reduction plants, smelters and available water powers in different parts of the United States. His report, delivered July 31, 1918, recommended certain changes in the distribution of pure aluminum and in its use in manufactured articles, which recommendations were immediately put into effect by the Council of National Defense.

He was then assigned to the Department of Military Aeronautics and owing to his being a member of the Naval Consulting Board where the aerial torpedo had originated, he was, upon request of the Secretary of the Navy to the Secretary of War, placed in command for the Army and given full authority for the development and production of aerial torpedoes. These consisted of small aeroplanes, carrying high explosives, designed to be entirely automatic in their functions, two types being developed.

Upon the signing of the Armistice Colonel Arnold was desirous of returning to civil life. He made a detail secret report of his last activity to the Secretary of War through the Director of Military Aeronautics on January 31, 1919, and on that same date resigned from the Army. He remained, however, at the request of the Director of Military Aeronautics to make an investigation and report upon the advisability of retaining or abandoning Langley Field at Hampton Roads, upon which several millions of dollars had been spent. The question was whether to retain the field as the West Point of the Air Service, which would eventually require the expenditure of nearly as great a sum as had already been placed to its account, improving the grounds with permanent

buildings and constructing a sea-wall 3½ miles long, as had been recommended, to prevent the occasional flooding of the field as the result of high tides and a long prevailing east wind, or to abandon the field and lose the amount already invested in it. His recommendation was to retain the field, utilizing the permanent buildings which had been placed upon it, the abandonment of the construction of the sea-wall as statistics and the law of probabilities showed that it would only be of use on an average of once in thirty years, and the gradual replacement of the temporary buildings as the requirements for permanent buildings became necessary. These recommendations were followed. The report was dated January 31, and delivered February 6, 1919, and upon request, his resignation was accepted on the latter date.

Upon his resignation, and the acceptance thereof, the Director of Military Aeronautics requested him to remain in the service as a reserve officer and accept a Colonelcy. As the Officers Reserve Corps Act at that time prohibited the issuing of commissions higher than that of Major, a later change in the Act resulted in the following commissions being forwarded him from Washington: Major, Aviation Section, Signal Officers Reserve Corps, March 28, 1919; Colonel, Aviation Section, Officers' Reserve Corps, September 13, 1919; Colonel, Air Service, the Army of the United States, September 13, 1924; and upon his reaching the age limit of 64, Colonel, Auxiliary Corps, the Army of the United States, August 14, 1925, which rank he retained until the time of his death.

In addition to his service in the Army he served as a member of the Naval Consulting Board. This Board, of which Thomas A. Edison was president, consisted of twenty-four men selected from twelve of the leading national engineering and scientific societies by the societies themselves and appointed with the approval of the President, by the Secretary of the Navy. Its duties were to review and pass upon the merits of inventions for war purposes that were offered to the country during the war and to help co-ordinate and develop protective and offensive means for both the Army and the Navy, and it served in this capacity from 1916 until the Army developed a department of its own for such work when it continued to act for the Navy.

Arnold was at one time invited to join the Construction Corps and later the Department of Aeronautics of the Navy and at another time to join the staff of General Goethals, but declined because of his belief that acceptance would prevent his going overseas. Fate decreed otherwise. Like most men who voluntarily put on the uniform his desire was to get across and to the front and at one time was offered the Lieutenant Colonelcy of the 37th Regiment of Engineers which later saw much service at the front. The importance of the aluminum investigation in the judgment of the Secretary of War prevented his acceptance, and, ironically, the officer whom Arnold recommended to take his place came home as Colonel of the Regiment. Thus it was decreed that his work for the Government should all be of a secret and arduous nature, but the records show that it was thoroughly done.

Colonel Arnold's interest in aeronautics was purely non-commercial, dating from 1889. He was a member of the "Committee on Aeronautics"

at the World's Columbian Exposition, Chicago, 1893, and later an interested observer and believer in the "gliding experiments" of Octave Chanute, in the sand dunes at the head of Lake Michigan, afterwards purchasing a farm on the St. Joseph River, near St. Joseph, Michigan, in order to carry on experiments of his own. Information later given him privately by Mr. Chanute led him to believe that the Wright brothers had succeeded in accomplishing mechanical flight, whereupon he abandoned his project and followed the work of these pioneers with interest. He gave the prize for the international balloon race held at Chicago, July 4, 1908, and witnessed, as the guest of Army Officers in charge, the first flight of Orville Wright at Fort Myer, Virginia. He was a member of the Aero Club of America during the time it was doing pioneer work in fostering aeronautics; was a director of the Aero Club of Illinois at the time of the Gordon-Bennett race held at Chicago in 1912, and was president of the Club in 1912-13. On leaving the Army he took an active part in organizing the Illinois Section of the American Legion, being Chairman of the finance committee prior to the Peoria and St. Louis Conventions, and later a delegate to the First National Convention held at Minneapolis, November 10-12, 1919. Afterwards he organized the Air Board of Chicago, consisting of representatives of the Chicago Association of Commerce, the principal clubs and other bodies interested in aviation, with the object of making Chicago a flying center. This resulted in the work being taken up by the Association of Commerce, leading to the present status of Chicago in the aviation industry.

Colonel Arnold was a member of the American Institute of Electrical Engineers (president 1903-04) and delegate to the International Electrical Congress, Paris, 1900; member of the American Society of Civil Engineers; member of the American Society of Mechanical Engineers; member of the American Institute of Consulting Engineers; member of the Inventors' Guild; member of the Western Society of Engineers, of which he was president 1906-07 and at the time of his death the senior past-president; member of the American Society for Promotion of Engineering Education; First Vice-president and Chairman Executive Committee International Electrical Congress, St. Louis, 1904; Vice-president American Association for Advancement of Science, 1915; trustee of Hillsdale College, Michigan; member of the board of trustees Lewis Institute, Chicago; Chairman of the American Committee on Electrolysis in the United States, 1914. In 1920-22 he was a member of the Advisory Commissions of the Illinois Central Railroad on its Chicago Terminal Installation, and of the Delaware, Lackawanna & Western Railroad in 1922 to determine and recommend the type of system of electrification to adopt. In both cases his recommendations were followed.

In the list of Colonel Arnold's inventions are: a magnetic clutch; a power station system, storage battery improvements, and new systems and devices for electric railways. He was one of the pioneers in the development of the single-phase electric traction system, as well as the present standard alternating-direct current system; was the first to recognize the necessity for and to put into practice the now generally

used automatically controlled substation for electric railways, which he assisted in the development of and assumed the engineering and financial risk for the first installation. During his professional career he had charge of the expenditure of more than $100,000,000 on work of his own design and in addition reported upon and had charge of the valuation of properties built by others aggregating in value more than one billion dollars.

In recognition of his engineering work he received diplomas, awards and medals from expositions, scientific institutions educational bodies and the Government, among them being: for "Engineering Designs," Trans-Mississippi Exposition, Omaha, 1898; "Electric Power Station System," Pan-American Exposition, Buffalo, 1901; "Magnetic Clutches," Edward Longstreet Medal of Merit, Franklin Institute, Philadelphia, 1903; from the Government, 1920, for "Valuable Aid and Assistance to the Navy during the World War," and in 1929 the "Washington Award."

The Washington Award is an Honor Award for pre-eminent service. It was established in 1916 by Mr. John Watson Alvord, a distinguished civil engineer, of Chicago, and a past-president of the Western Society of Engineers. The Award is conferred by the Western Society of Engineers upon the recommendation of a Commission of Award consisting of representatives of the American Society of Civil Engineers; the American Society of Mechanical Engineers; the American Institute of Mining and Metallurgical Engineers; the American Institute of Electrical Engineers, and the Western Society of Engineers. The Award, named after the first President of the United States, an engineer, is by the terms of its founder, "an honor conferred upon a brother engineer by his fellow engineers on account of accomplishments which pre-eminently promote the happiness, comfort and well-being of humanity," through engineering, the wording of each award being varied to suit the particular qualifications and accomplishments of the recipient. Colonel Arnold was the eighth of the distinguished line of recipients of the Award, his predecessors being Herbert Clark Hoover, 1919; Robert Woolston Hunt, 1922; Arthur Newell Talbot, 1923; Jonas Waldo Smith, 1925; John Watson Alvord, 1926; Orville Wright, 1927; and Michael Idvorsky Pupin, 1928.

Following the presentation of the Washington Award Colonel Arnold divided his time between his work as Chairman of the Board of Supervising Engineers, Chicago Traction, and a plant erected at Marengo, Illinois, for the development and manufacture of magnetic steel, and in research. He was active in these works right up to the time of his death, January 29, 1942, which came suddenly, none of his many friends suspecting any serious illness.

He became a member of the Railway & Locomotive Historical Society in 1921, keeping his membership continuously until his death. When the Chicago Chapter was organized he was one of the first to come forward and ask to be admitted to its roster, offering his assistance in any matters in which he might be of help to its officers and members and was always willing to take time from his busy life to offer counsel to

those who asked it. The Society and Chapter were honored by his participation in activities sponsored by them.

Seeking fame for the sake of fame alone was not in the Arnold code. Nor was his word, once given, lightly held in the fulfillment of the promise made. Just as he carefully observed his agreements with others, he insisted that they as carefully observe their agreements with him. Underneath a quiet and unassuming exterior there lay an unshakable faith in his ability to master the tasks he undertook, and once committed he carried on tenaciously until his victory was won. The Chicago *Daily News*, in an editorial of February 3, 1942, said in part: "But to Arnold, to say something was impossible was to suggest a solution, and that usually by converting an obstacle into a highway of success." His own attitude toward life and work may best be expressed by quoting from his speech of acceptance of the Washington Award, February 21, 1929:

> "Have an ideal and work toward it. You will have your disappointments and your temptations but keep your record clean, and if anyone says you are foolish or ugly, or homely, or that you need a guardian, take the criticism with a smile, for he may be able to prove his contention; but if he attacks your integrity, strike at once and fight hard, for he has assailed not only your character but your principal asset as an engineer.
>
> "If you think your work is hard and that your rewards are coming slowly, remember that the work of the engineer, like that of the newspaper man and those in many other walks of life, is a continual grind unless you are greatly interested in your work. So be ye not envious of the men who receive such distinctions as this award, splendid as they are when they come, for remember that, according to the Good Book, even Noah, the first naval architect of record, notwithstanding his good deeds and uprightness of character, lived to be 600 years old before he was called upon to build the ark that made his name immortal.
>
> "So my young and struggling friends who have youth and strength, and hope, your turn may come, but there is one thing certain, especially in the engineering profession, it will not come unless, in the parlance of the street, 'you deliver the goods.'"

* * * * *

The material for this short sketch was drawn mainly from a reprint of pages 122 to 145 of the *Journal of the Western Society of Engineers*, Chicago, Vol. XXXIV, No. 3, March, 1929. The writer wishes also to thank Mr. Charles Dorsett, Secretary of the Board, Chicago Traction, and Mr. Stanley Arnold for their fine cooperation in the preparation of these notes.

Of the model locomotive, which by Colonel Arnold's own word is a reproduction of Burlington & Missouri River Railroad locomotive No. 31, we know only that the original was built by Manchester in August, 1879, and scrapped during January, 1901. The model was painted to reproduce exactly the color scheme of the prototype when new and the care given it through the years has kept the colors and the finished metal bright. A glass case to house it, built many years ago, has added materially to its preservation. Arrangements have been made to place the model in the Museum of Science and Industry, Jackson Park, Chicago, following Colonel Arnold's wishes, thus making it possible for all to see the early work of the young genius.

Three-Cylinder Locomotives

By Paul T. Warner

Why a three-cylinder locomotive? In order to answer this question, let us first consider briefly the defects and deficiencies of the two-cylinder design.

As we all know, the crank pins on the opposite sides of a two-cylinder locomotive are placed at right angles to each other, so that when one side is on the dead point, the other is in a position to exert maximum turning effort. As a result of the combined effect of the two cylinders, this turning effort is constantly varying throughout a revolution, there being two high points and two low points. Thus, a locomotive with 29x30-inch cylinders, driving wheels 67 inches in diameter and a steam pressure of 220 pounds, develops an average starting tractive force throughout a revolution of the drivers, of 70,400 pounds; but the maximum tractive force is 23% in excess of this, and the minimum is 23.6% less. This results in an uneven draw-bar pull and a greatly increased tendency to slip at certain crank positions. If the engine is designed to use a limited cut-off at starting speeds, the amount of variation is reduced; but such variation is always present to a greater or less extent.

Now if this locomotive, instead of having two 29x30-inch cylinders, has three 25x30-inch cylinders with cranks placed 120 degrees apart, the turning effort is far more uniform throughout a revolution. The average, or normal, starting tractive force is 78,500 pounds as compared to 70,400 pounds for the two-cylinder locomotive, but the maximum tractive force in one revolution of the drivers is only 9.7% greater and the minimum only 11.5% less. In other words, by using three cylinders the starting tractive force is increased 11% without increasing the tendency to slip. This means, with a given wheel arrangement and weight on drivers, quicker starting and accelerating power and increased hauling capacity.*

The two-cylinder locomotive is at a further disadvantage on account of the disturbing effects of the reciprocating parts of its machinery, consisting of the pistons and their rods, the crossheads, and the forward sections of the main rods. These parts have a forward-and-backward, or reciprocating, motion; while the rear sections of the main rods, together with the coupling rods, crank-pins and crank-pin hubs, have a revolving motion. These revolving weights can be accurately balanced by putting a counterweight in each wheel opposite the crank pin; but if the reciprocating weights are left unbalanced, a serious vibration, known as "nosing," will be set up in a horizontal plane. The early locomotive designers found that the closer they kept the reciprocating weights to the center line of the engine, the less the tendency to nose; and this accounted for the popularity of the inside-connected design, which held its popularity in many foreign countries—especially Great Britain—until recent years. The method adopted to counteract the dis-

* The figures given in this and the preceding paragraph were taken from a pamphlet published by the American Locomotive Co.

turbing effects of the reciprocating weights in outside-cylinder locomotives was to place an excess amount in the counter-weights in the wheels; and this method is still used. These excess weights reduce the nosing effects, but they set up a vertical disturbance, or so-called "hammer blow," which increases the pressure of the driving wheel on the rail when the counter-weight is down, and reduces it when the same weight is up. The best that can be done is to effect a compromise, putting in sufficient additional weight to prevent excessive nosing, but not enough to cause a hammer blow that will damage the track. It is evident that the lighter the reciprocating parts, the more satisfactorily can the engine be balanced. This explains why certain designs of compound locomotives, which had a high and a low pressure cylinder on each side with the two pistons connected to the same crosshead, were hard on the track and very rough riding. To prevent severe nosing, so much excess weight had to be put in the counter-balance that the hammer blow was destructive at high speeds.

The three-cylinder locomotive, with lighter reciprocating weights than a two-cylinder engine of equal power, can be more satisfactorily balanced both horizontally and vertically, so that it rides more steadily and is easier on tracks and bridges. With given track conditions this permits more weight to be safely placed on each pair of drivers of the three-cylinder design, as compared with the two-cylinder.

Records indicate that the first three-cylinder locomotive was built in England in 1846, when British patent No. 11,086, covering such an engine, was granted to Robert Stephenson and William Howe. This locomotive had a single pair of driving wheels, in front of which were two pairs of carrying wheels rigidly held in the frames. The pistons of the two outside cylinders were connected to crank pins which were in the same relative positions in their respective wheels, the angle between them being zero; while the inside crank was at right angles to the outside pins. The object of the design, as stated in the patent specification, was "to counteract or neutralize all tendency that the oblique action of the several connecting rods on their respective crank pins may have to produce a lateral vibration or rocking motion of the locomotive engine from side to side on its supporting springs when it is travelling very rapidly." The nosing effect in a horizontal plane was also eliminated with this curious arrangement; but, unless excess counterweights were placed in the wheels, there would be a tendency to surge in a fore-and-aft direction. The locomotive was extensively rebuilt by the Stephensons in 1853, but the three-cylinder arrangement was retained. D. K. Clark, in *Railway Machinery*, published in 1855, has this to say regarding this locomotive:—

> "As the movements of the reciprocating masses acting out of the center line of the machine, exactly balance each other, the tendency to sinuous action is removed, and fore and aft action alone remains to be balanced. This engine, accordingly, runs with very superior steadiness, even when unassisted with balance weights in the wheels; and from its peculiar arrangement, it is susceptible of a very perfect equilibrium. It is found to give unqualified satisfaction on the York, Newcastle and Berwick Railway, where it is on regular duty."

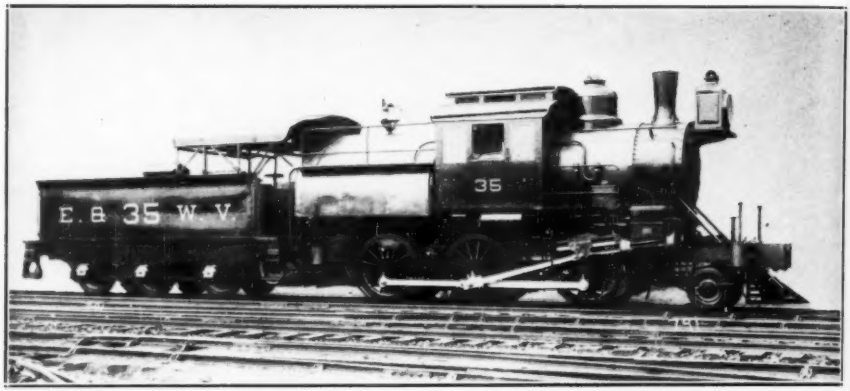
In 1847, before it was rebuilt, this locomotive hauled a special train a distance of 41 miles in 42 minutes—quite a record at that time. The locomotive is stated to have run with great steadiness at the highest velocities.

Shortly after the Stephenson and Howe locomotive was completed, designs for a three-cylinder engine were prepared by the Philadelphia, Wilmington and Baltimore Railroad Company in this country. The Annual Report for the year 1848 states that such a locomotive, which had been rebuilt from a two-cylinder engine, was placed in service in January of that year; and the Annual Report of 1849 states that two three-cylinder locomotives were then in service and were giving satisfaction. According to the late J. Snowden Bell, who read a paper on three-cylinder locomotives before the Master Mechanics Association at the 1913 Convention, these locomotives were the "George Washington" and the "Ohio," originally built by the Norris Works in Philadelphia, and rebuilt at the Company's Canton Shops in Baltimore. Unfortunately, records regarding them are very meager, and it is not known how long they continued in operation.

Apparently the next actual application of three cylinders to a locomotive was made in 1880, when John B. Smith, Superintendent of the Pennsylvania Coal Company, built four small switching locomotives of the 0-4-0 type for service around the mines. According to J. Snowden Bell, these locomotives had three 8x12-inch cylinders, driving wheels 32 inches in diameter, and weighed each about ten tons. They were presumably satisfactory; for in 1892 Mr. Smith designed a three-cylinder passenger locomotive of the 4-4-0 type, and such a locomotive was built at the works of the Dunmore Iron and Steel Company for service on the Erie and Wyoming Valley Railroad, now part of the Erie System. This locomotive had three horizontal cylinders, 15x24 inches in size, with pistons all connected to the first pair of driving wheels and cranks 120 degrees apart. Mr. Bell states that about the same time the Erie and Wyoming Valley placed in service four locomotives of the 0-8-0 type, with three cylinders. Apparently no particulars of these locomotives were published or are available.

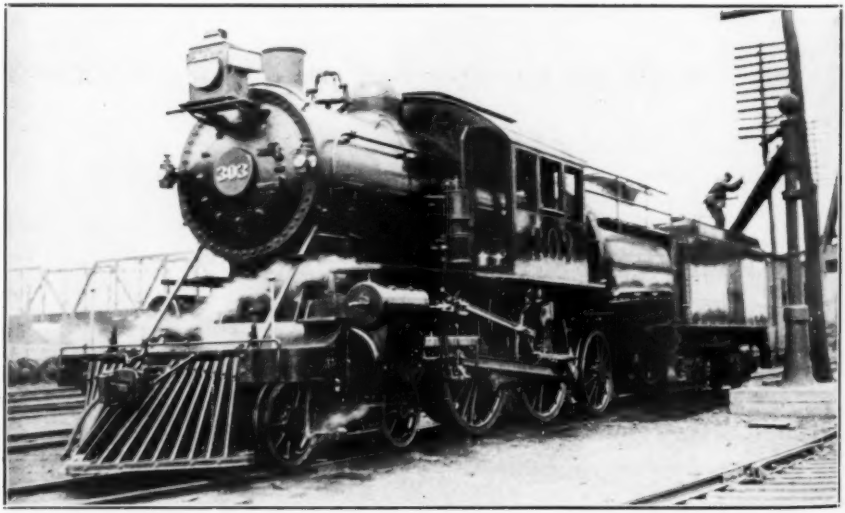
In 1894, the Baldwin Locomotive Works built three freight locomotives of the 2-6-0 type for the Erie and Wyoming Valley Railroad. Each locomotive had three 17x24-inch cylinders, which were placed in line under the smokebox, the inside cylinder with its center 12⅞ inches to the right of the center line of the locomotive. The cranks were placed 120 degrees apart, and all three cylinders were set on an incline of 4 in 35 so that the inside crosshead and main rod would clear the first driving axle. These locomotives were reported to have high starting and hauling power in proportion to their weight. They were hard-coal burners, with Wootten boilers and centrally-located cabs. Due to trouble with the crank axles, they were subsequently rebuilt with two cylinders.

We must now revert, for a short time, to Great Britain and Europe, calling attention first to the famous Webb compounds on the London and North Western Railway. These were designed in accordance with a



—Courtesy of Baldwin Locomotive Works

Erie & Wyoming Valley R. R.—#35—Baldwin 1894—Three Cylinders, 17"x24"



—Courtesy of C. B. Chaney.

P. & R. #303—Reading Shops 1909—Three Cylinders, 18½"x24"

patent granted to F. W. Webb, Chief Mechanical Engineer of the Railway, in 1881; and up to 1893 over 100 were built. Included among them was one constructed in 1889 by Beyer, Peacock and Company for the Pennsylvania Railroad, which was used for experimental purposes. It was given the road number 1320, and the writer saw it on several occasions. To comply with service requirements in this country, it was shockingly disfigured by the application of a pilot, cab and certain other American gadgets. It proved an interesting machine wherewith to experiment, but needless to say its term of active service was short. It was finally cut up in 1898.

The majority of these Webb compounds had a single pair of leading wheels and two pairs of driving wheels. The latter were uncoupled, the two outside high-pressure cylinders driving the rear pair, and a single inside low-pressure cylinder the forward pair. In the largest of these locomotives, including the one on the Pennsylvania, the inside cylinder had the exceptionally large diameter, for that time, of 30 inches. The corresponding high-pressure cylinders measured 14 inches in diameter.

The Webb compound locomotives, although specially nursed and favored on the London and North Western, were only partially successful. They were not particularly speedy, and had low starting power. If one of the high-pressure cranks, and also the low-pressure crank, happened to be on a dead point at the same time, the locomotive could not start a heavy train without being "pinched" with the help of crowbars; and cases are on record where four men had to pry them off the dead point in order to get going. In some of them the high and low pressure valve motions were so arranged that it was possible, when trying to start, to have the rear drivers slipping in the forward direction while the front drivers were slipping in the opposite direction. It is not surprising therefore, that on Mr. Webb's retirement, about 1903, they were promptly scrapped.

The Webb compound locomotives furnish a conspicuous illustration of how it is possible to keep an inefficient device in service, provided it is "daddied" by an official having the requisite amount of authority.

Only a brief reference can be made to the subsequent development of the three-cylinder locomotive abroad, although the story is one of great interest in view of the present popularity of the type, especially in Great Britain and Germany. In both countries three-cylinder locomotives are used extensively in freight as well as in passenger service, and they include a variety of wheel arrangements. Among the German locomotives, the 2-10-0 (Decapod) type engines used in heavy freight service on the State Railways are particularly noteworthy. These engines, built to the metric system, have approximate cylinder dimensions of 22½x26 inches, and driving wheels 55 inches in diameter; very moderate sizes when compared with those used in this country.

The German State Railways in 1935 placed in service several high-speed locomotives of the 4-6-4 type, with three cylinders. The steam pressure is 284 pounds, and the driving wheels are 90½ inches in diameter. These locomotives are fully stream-lined, the shrouding being

carried down almost to the rail line. They are designed to handle trains weighing 275 tons behind the tender, and with such a train a maximum speed of 112.4 miles an hour has been reached; while on a special test, one of the locomotives attained a speed of 119 miles an hour.

In Great Britain, the chief reason for the use of the three-cylinder design has been to secure maximum capacity within restricted clearance and weight limitations. The 4-4-0 type compound locomotives on the London, Midland and Scottish Railway, of which about 200 are in use, are conspicuous examples. These locomotives were built during the period 1901-1924. The design was originally adopted under the urgent necessity of securing increased power without raising the axle loading or increasing the over-all dimensions of existing locomotives. In these engines the inside cylinder is the high-pressure; and the two outside cylinders, of slightly greater dimensions, are the low-pressure. All three pistons are connected to the first driving axle.

The locomotive *Royal Scot*, which excited so much interest when it toured this country in 1933, represents a larger development; as it is of the ten-wheeled (4-6-0) type. The three cylinders are all of the same dimensions and work single-expansion; so that the diameter of the outside cylinders is actually less than in the 4-4-0 type compounds. While some economy is probably sacrificed on this account, increased power is obtained with no increase in over-all dimensions. Other notable three-cylinder locomotives are the large 4-6-2, 2-8-0 and 2-8-2 types in service on the London and North-Eastern Railway, designed by H. N. Gresley,* Chief Mechanical Engineer. One of his latest triumphs is the superb 2-8-2 type locomotive "Cock-O'-the-North," built for express passenger service on steep grades. This locomotive is fitted with poppet valves, and while its dimensions are moderate as compared with the heaviest American practice, it represents one of the most advanced designs in service today. Still more recent is the "Silver Link" class, a stream-lined 4-6-2, which is operating between London and Newcastle at an average speed of 67 miles an hour.

Following the Erie and Wyoming Valley locomotives, the next examples of the three-cylinder type to be placed in service in the United States were designed by Howard D. Taylor, a former Superintendent of Motive Power and Rolling Equipment of the Philadelphia and Reading Railway Company, and were built at the Reading Shops. Engine 303, a 4-4-2 type, was completed in June, 1909; engines 300, another 4-4-2, and 675, a 4-6-0 type, in June 1911, and engine 344, a 4-4-2, in May, 1912. Although they were all subsequently rebuilt with two cylinders, they were undoubtedly among the most successful three-cylinder locomotives ever used in this country, and were outstanding examples of excellent design and fine workmanship.

No two of these locomotives were exact duplicates, although they all had various prominent features in common. The boilers were of the Wootten type with combustion chambers, and engine 344 was the first Reading locomotive to be fitted with a Schmidt superheater. Engines

*H. N. Gresley died April 5, 1941.

300, 303 and 675 were fitted with a superheater located in the front course of the boiler, as patented by Mr. Taylor. The superheater chamber was about three feet in length, and was enclosed between two tube-sheets and traversed by the boiler tubes. The steam was conveyed to the top of the superheater chamber through an internal dry-pipe leading from the dome, and it then followed a circuitous course to the forward end of the superheater, being guided by transverse baffle plates. The outlet from the superheater was through a throttle valve, which was placed in a box in the top of the superheater chamber and communicated directly with the steam pipes leading to the cylinders. With this arrangement the superheater was filled with steam even when the throttle was closed.

It is probable that the device just described gave only a very moderate degree of superheat, and when these locomotives were subsequently rebuilt with two cylinders, dome throttles and superheaters of the Schmidt type were installed.

The cylinders in all these locomotives were horizontal and placed in line under the smokebox, the piston of the inside cylinder being connected to the first driving axle and those of the outside cylinders to the second pair of drivers. The cylinder group comprised three castings; a central saddle which enclosed the inside cylinder, and a separate casting for each of the two outside cylinders. This arrangement was patented by Mr. Taylor. Walschaerts valve gear was used for the outside cylinders, and a Joy gear, actuated by the inside main rod, for the central cylinder. All three motions were controlled by one reverse lever.

In this connection it should be recorded that in 1910 Richard W. Kaucher, who is now Chief Draftsman at the Reading Shops, assigned to Howard D. Taylor a patent covering a design of valve motion for three-cylinder locomotives. In this device the motions of the two outside valves were combined to operate the valve for the central cylinder. The mechanism consisted of an arrangement of links and vibrating levers which were placed in a horizontal plane back of the cylinder saddle. The same general principle, but differing in detail, was subsequently adopted on the three-cylinder locomotives designed in England by H. N. Gresley, and was used on all the three-cylinder engines built by the American Locomotive Company. The Kaucher gear was never actually applied to a locomotive, but a scale model was made to prove that it was practical.

The Reading three-cylinder locomotives did their best work in high-speed service between Philadelphia and Jersey City and between Camden and Atlantic City. Prior to the World War the fastest trains on the Jersey City run were scheduled to cover 90.2 miles in 98 minutes, including two stops. Both types of three-cylinder locomotives demonstrated their ability to make this time; and the fastest running that I have ever experienced was accomplished one morning in November, 1912, by engine 344, while hauling the 8.00 o'clock train out of Philadelphia. On that occasion twelve miles of descending grade approaching the Lehigh Valley crossing near Bound Brook were covered in eight minutes four seconds; had the four seconds been cut off, the average speed for

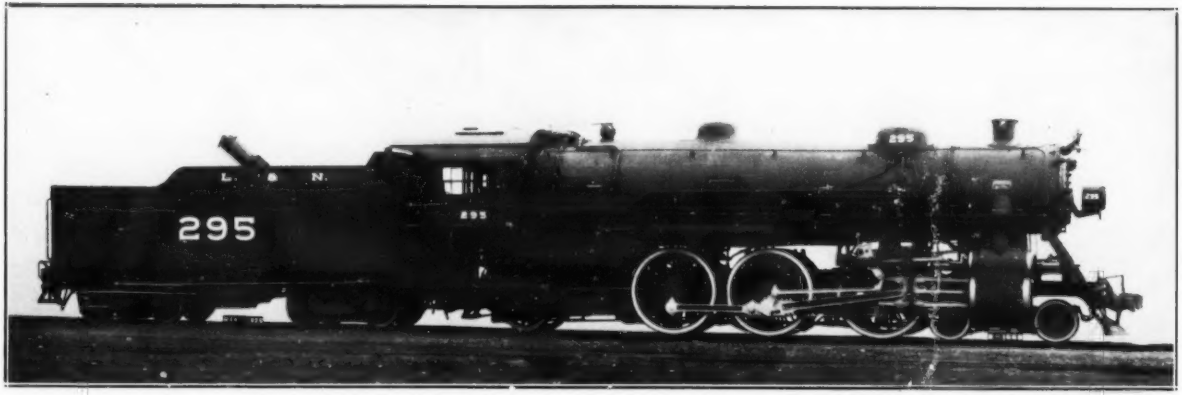
the twelve miles would have been 90 miles an hour. Several steam locomotives have recently been built which are undoubtedly able to exceed this speed by a considerable margin; but it is unfortunate that in discussing them, various impossible stories about extreme speeds, which originated some years back, have been resurrected and widely circulated. We should, I feel, be cautious about accepting as true, many published statements regarding extremely high speeds.

The crank axles of the Reading three-cylinder locomotives ultimately failed at the center crank pins, and the engines were rebuilt with two cylinders during 1916 and 1917, after Mr. Taylor had left the service of the Reading Company.

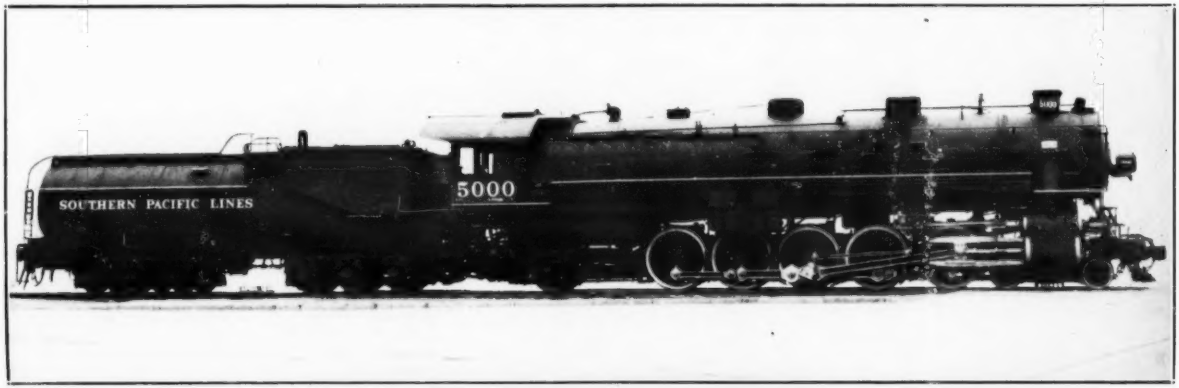
Subsequent to the building of Reading locomotive No. 344, there was a period of ten years before another three-cylinder locomotive appeared in the United States. In 1922 the American Locomotive Company, in order to determine what advantages, if any, could be realized by using three-cylinder locomotives in heavy service, converted a 4-8-2 type fast freight locomotive of the New York Central Lines from the two-cylinder to the three-cylinder type. In rebuilding this locomotive a trailing truck of the Delta type, with booster, was applied; the superheater was changed from a type A to a type E, and an Elesco feed-water heater and an Elvin stoker were installed. The two original cylinders, which were 28x28 inches in size, were replaced by three 25x28-inch cylinders. All three pistons were connected to the second pair of driving wheels. The two outside cylinders were horizontal, while the central cylinder was inclined at an angle of 8½ degrees to allow clearance for the inside main rod above the first driving axle. The piston valves for the two outside cylinders were operated by Walschaerts valve gear, and the movements of the outside valves were combined by means of an arrangement of vibrating levers placed in front of the cylinders, to operate the valve for the central cylinder. The arrangement was similar to that which had been previously adopted by H. N. Gresley on the Great Northern Railway of England.

The rebuilt locomotive was placed in fast freight service on the Mohawk Division of the New York Central, and operating results were so promising that the American Locomotive Company built a new three-cylinder 4-8-2 type locomotive from the ground up. This was Lehigh Valley engine No. 5000, which was completed at the Brooks Works in October, 1923. It had the same size cylinders and drivers as the New York Central rebuilt locomotive, but the power application was divided, the inside cylinder driving the second pair of wheels, and the two outside cylinders the third pair. A type A superheater and an Elvin stoker were applied.

This locomotive was tested in fast freight service on the Buffalo Division of the Lehigh Valley, and also in fast, heavy milk train service between Sayre and Lehighton, via the Mountain Cut-off near Wilkes-Barre. It showed excellent economy, high power and rapid acceleration; and proved so satisfactory that five additional locomotives of similar construction were ordered from the American Locomotive Company by



L. & N. #295—A. L. Co. 1925—Three Cylinders, 22½"x28" —Courtesy of American Locomotive Company.



S. P. #5000—A. L. Co. 1925—Three Cylinders, 25"x28"x32" —Courtesy of American Locomotive Company.

S. P. 5000—A. L. Co. 1925—Three Cylinders, 25"x28"x32" Courtesy of American Locomotive Company.

the Lehigh Valley. The writer had the fun of riding one of these engines from Sayre to Lehighton one very hot afternoon in June, 1926, while it was hauling a heavy milk train. The running schedule was comparable to that of the "Black Diamond," and the locomotive was certainly speedy and easy riding.

The success of these locomotives encouraged the American Locomotive Company to launch a vigorous advertising campaign featuring the three-cylinder locomotive, and the results—at least from the builder's standpoint—were fairly gratifying. Various railroads ordered sample locomotives or purchased them in small lots, while several—notably the Southern Pacific, Union Pacific, and Lackawanna—bought them in larger numbers. The other locomotive builders, however, proceeded more cautiously. The Lima Locomotive Works, as far as the writer is aware, has no direct-connected three-cylinder locomotive to its credit; while The Baldwin Locomotive Works had had some rather bitter experiences with certain types of four-cylinder compound locomotives, and therefore hesitated to recommend multi-cylinder designs. In 1925, however, they built a heavy switching and transfer locomotive for the Belt Railway of Chicago, and they also built two other out-standing designs for domestic service—ten 4-8-2 type passenger locomotives for the Denver and Rio Grande Western Railroad, and the experimental 4-10-2 type, three-cylinder compound No. 60,000 which is now, as you are all doubtless aware, reposing in the Franklin Institute Museum in Philadelphia.

The Rio Grande locomotives, which were built in 1926, are among the most powerful units of the 4-8-2 type ever constructed. They were designed to handle passenger traffic on grades as steep as 3 per cent and curves as sharp as 16 degrees, and they develop a maximum tractive force of 75,000 pounds, with 290,500 pounds on drivers. The three cylinders are cast separate from each other, the middle cylinder casting being in one piece with the saddle which supports the smokebox. There are three Walschaerts valve gears, one on the left side for the left-hand cylinder, and two on the right side for the middle and right-hand cylinders. There is a double return crank on the right-hand side, with two pins, one set to drive the link for the middle cylinder, and the other for the right-hand cylinder. This arrangement has been used on the majority of the three-cylinder locomotives built by The Baldwin Locomotive Works.

The writer had an opportunity to see something of these engines in the summer of 1927, when he made a trip over the Denver and Rio Grande Western. The most interesting experience was a ride in the cab of engine 1605 through the Royal Gorge, with Train No. 1, composed of 15 cars. The manner in which this locomotive started the train at Hanging Bridge and handled it over long grades of 1.42 per cent, was most impressive. The Division Superintendent was on the engine at the time, and he and several other officials of the road spoke very highly of the three-cylinder locomotives; but the enginemen did not like them. They were afraid of the inside cylinder and its rather inaccessible machinery; as one veteran runner remarked, "That engine would be all right—if it

had only two cylinders." The opinions of the fireman, in this case, were more emphatic and comprehensive; he literally cussed everything on the locomotive from the pilot to the back bumper. One's opinion of an individual, if based merely on hearsay and a casual acquaintance, may be very different from that of another person who is compelled to work with him every day; and the same is apparently true of locomotives.

Some further reference should here be made to Baldwin engine No. 60,000, which was built in 1926 to demonstrate the advantages of using high-pressure steam in three cylinders arranged on the compound system, with one high-pressure cylinder inside and two low-pressure outside. This locomotive is of the 4-10-2 type, and in designing it the Southern Pacific 2-10-2 type locomotives, a large number of which had previously been built by The Baldwin Locomotive Works, were used as a base. As it was desired to carry a steam pressure of 350 pounds in No. 60,000, a water-tube firebox was applied, and in its construction neither flat surfaces nor stay-bolts were employed. This firebox has two longitudinal drums at the top, while its base is a huge cast steel frame or mud ring, which is cored out for water circulation and which was a difficult casting to make. The upper drums and the mud ring are connected by water-tubes at the sides and back, and the boiler barrel and the front of the mud ring are connected by two large circulating pipes. Forward of the firebox the boiler is of conventional construction, built of heavy plates and with seams designed to carry high steam pressure. The three cylinders with their steam chests are combined in a single iron casting which is a fine specimen of high-class foundry work. The inside high-pressure cylinder is placed on an incline, with its piston connected to the second driving axle; while the pistons of the outside cylinders are connected to the third pair of drivers. The first driving axle is made with a kink in order to clear the inside main rod. As only the outside cylinders exhaust up the stack, the two outside crank pins are placed 90 degrees apart, and the inside crank is set at an angle of 135 degrees with each outside crank. This results in four even exhausts per revolution. In starting, live steam can be admitted direct to the low-pressure cylinders through a valve which is manually controlled from the cab; but as soon as these cylinders begin to receive the high-pressure exhaust, the starting valve should be closed.

This locomotive was given a thorough test on the Pennsylvania's stationary plant at Altoona, and it then tramped the country to the Pacific Coast and back. It was tried out in both freight and passenger service, on various railroads and under a wide variety of service conditions; and for a time was equipped to burn oil instead of coal. It operated with high efficiency both on the Altoona Plant and on the road, and considering its unusual design, proved reliable in heavy service. But no railroad company became sufficiently interested to purchase it, and after lying idle in the Eddystone erecting shop for several years it was placed in the new Franklin Institute Museum in Philadelphia where some of you have seen it, and where it will undoubtedly end its days.

The majority of the three-cylinder locomotives built by The Baldwin Locomotive Works were exported, and are operating in Brazil, Siam, the Philippine Islands, and China. All were designed in accordance with American practice and have apparently been successful in service.

The American Locomotive Company have applied the three-cylinder principle to the 4-6-2, 0-8-0, 2-8-2, 4-8-2, 4-10-2 and 4-12-2 types, so that it has been tried out under a great variety of service conditions. From the standpoint of both capacity and design the most interesting of these locomotives are the huge 4-12-2 type engines, of which a total of 88 have been built for the Union Pacific System. With a total weight, exclusive of tender, of 495,000 pounds, and a rated tractive force of 96,650 pounds, these are the largest and most powerful non-articulated locomotives ever built. The design was prepared after a careful study had been made of the operation of two-cylinder 2-10-2 type, three-cylinder 4-10-2 type and Mallet compounds 2-8-8-0 type locomotives in freight service on heavy grades. The Mallets lacked the speed capacity desired in road service, and the new locomotives were designed to combine their hauling power with the speed capacity of the 2-10-2 and 4-10-2 types. With a weight limitation of 59,000 pounds per pair of drivers, six coupled axles were required. This necessitated the use of three cylinders in order to develop the required tractive force and at the same time keep the piston thrust and the weight and size of the machinery details within reasonable limits. By applying a lateral motion device to the front and rear pairs of drivers, the locomotives can traverse curves as sharp as 16 degrees. These were undoubtedly the first locomotives to be built in this country with six axles coupled in one group, since James Millholland built his 0-12-0 type tank locomotive *Pennsylvania* in the shops of the Philadelphia and Reading Railroad in 1863. Within recent years, however, the Austrian State Railways of Europe have used four-cylinder compound locomotives of the 2-12-0 type, with all six driving axles coupled in one group; and a two-cylinder locomotive with seven pairs of coupled drivers is now in operation in Russia.

The first 4-12-2 type locomotive was delivered to the Union Pacific in April, 1926, and it proved so satisfactory that four successive orders for similar locomotives were placed with the American Locomotive Company, the last group being built in 1930. On the 361-mile run between Wahsatch, Utah, and Laramie, Wyoming, these locomotives handle 3500-ton trains at an average speed of 27.4 miles an hour. This division has grades up to 0.81 per cent. On the 1.55 per cent grade between Cheyenne, Wyoming, and Laramie, the 4-12-2 types handle the same tonnage as the 2-8-8-0 type Mallet compounds, and they do this at an increased speed and with reduced fuel consumption.

Subsequent to the building of the latest 4-12-2 type locomotives in 1930, there has been no demand for three-cylinder locomotives in this country; and a number of roads which were at first strong advocates of the three-cylinder arrangement have reverted to the two-cylinder design. The Lehigh Valley is using its three-cylinder locomotives in passenger service on the comparatively short run of 53 miles between Mauch Chunk

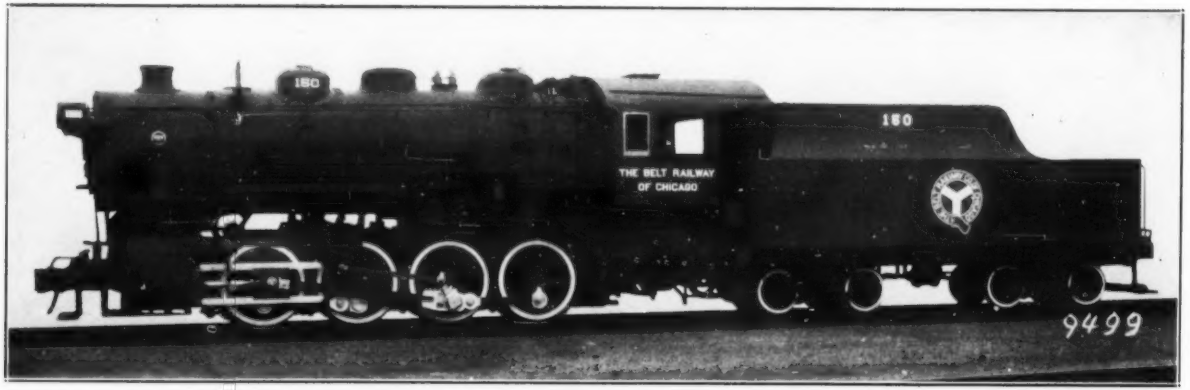
and Wilkes-Barre, where grades are steep and speeds are moderate; and the fast freight and milk trains are now being hauled by two-cylinder locomotives of the 4-8-4 type. The Lackawanna, while still using their three-cylinder freight locomotives, have rebuilt their passenger locomotives with two cylinders; while on the Denver and Rio Grande Western the huge three-cylinder 4-8-2 types are now hauling freight, and through passenger traffic is handled with more recent 4-8-4 type locomotives. The 4-10-2 type three-cylinder locomotives on the Southern Pacific have been replaced, on the hardest runs, by single-expansion locomotives of the 4-8-8-2 type.

Maintenance difficulties have been chiefly responsible for the decline in popularity of the three-cylinder type. The inside engine is difficult to get at for inspection and lubrication; there have been hot bearings, ground-up brasses, broken stub-straps and sundry other troubles. In a large engine the inside crank-pin, which also constitutes part of the driving axle, is over 12 inches in diameter; and this aggravates the tendency to heat when running fast, due to the high velocity of the rubbing surfaces. The average American railroader lacks patience, and for good reasons; he must keep the power in shape with a minimum amount of attention and expense, and he wants the machinery of his locomotives outside where it is easily accessible, even though certain theoretical advantages are lost thereby. The success of the 4-12-2 type locomotives on the Union Pacific is doubtless largely due to the fact that particular attention is paid to the maintenance problem on the principle that "a stitch in time saves nine"; for without such a policy these huge machines, with their long driving wheel base and multiplicity of main and side rods, would never prove a success. And it is the writer's opinion that a single-expansion articulated locomotive, say of the 2-6-6-4 type, with short rigid wheel-bases, lighter parts, and all machinery easily accessible, would prove a more practicable design than the present power.*

The success of the three-cylinder locomotive in certain foreign countries may be attributed to various causes. The largest of these engines are of moderate size compared to the huge machines used in this country; the detail parts are lighter and are more easily handled, and it is safe to say that the locomotives are more carefully maintained and that service requirements are less strenuous than they are here. More than that, our foreign friends—especially in Great Britain—have been brought up on inside cylinders and crank axles; they have always been used to them, and with the three-cylinder type have come no new problems nor difficulties.

Is there a future for the three-cylinder locomotive in this country? We would not say "No" in answer to this question. There are strong indications that the future tendency will be to use lighter locomotives capable of higher speeds, and developing maximum horsepower in proportion to total locomotive weight. The three-cylinder arrangement,

* Shortly after this was written, the Union Pacific began to purchase articulated locomotives of the 4-6-6-4 type for heavy fast freight service.



Belt Ry. of Chicago #150—Baldwin 1925—Three Cylinders, 23"x28" —Courtesy of Baldwin Locomotive Works.

Mo. P. #1699—A. L. Co. 1925—Three Cylinders, 23"x28"x32" —Courtesy of American Locomotive Company.

with its more even rotative effort, lighter machinery details, and better balance both horizontally and vertically, is admirably fitted to meet such conditions. With improved materials and methods of lubrication, and more careful maintenance, there would seem to be a bright prospect for the three-cylinder locomotive, which has certainly demonstrated its ability to do things that a two-cylinder locomotive of the same weight and nominal capacity cannot do.

NOTE—Present prospects for the three-cylinder locomotive are not as bright as they appeared to be when the above was written. Many of these locomotives, including those built for the Lehigh Valley, have been rebuilt with two cylinders; and the Diesel-electric is proving a successful competitor of the steam machine in high-speed service. Under the circumstances, it is extremely doubtful whether we shall see any three-cylinder locomotives placed in service on American railroads in the future.

P. T. W.

THREE-CYLINDER LOCOMOTIVES (DOMESTIC)

Built by the Philadelphia and Reading Railway Company at Reading Shops

Road Number	303	300	675	344
Date	1909	1911	1911	1912
Type	4-4-2	4-4-2	4-6-0	4-4-2
Cylinders, in.	18½x24	19x24	19x24	19x24
Drivers, diam., in.	80	80	74	80
Steam Pressure, lb.	225	240	240	230
Grate Area, sq. ft.	90.0	90.0	90.0	94.5
Total Heat. Surf., sq. ft.*	2846	3345	3345	3018
Weight on Drivers, lb.	106,150	108,000	158,000	128,300
Weight, total Engine, lb.	205,400	208,000	210,000	233,200
Tractive Force, lb.	29,450	33,140	35,830	31,760

* Includes superheating surface. Taylor superheater on engines 303, 300 and 675; Schmidt superheater on engine 344.

Built by The Baldwin Locomotive Works

Road	Erie & Wyoming Valley	Denver & Rio Grande Western	Belt Ry. of Chicago	B. L. W. No. 60,0000
Date	1894	1926	1925	1926
Type	2-6-0	4-8-2	0-8-0	4-10-2
Cylinders, in.	17x24	25x30	23x28	*27x32
Drivers, diam., in.	57	67	57	63½
Steam Pressure, lb.	150	210	200	350
Grate Area, sq. ft.	76.0	95.0	57.2	82.5
Water Heat, Surf., sq. ft.	1600	5093	2702	**5192
Superheating Surf., sq. ft.	——	1495	630	1357
Weight on Drivers, lb.	104,000	290,530	258,000	338,400
Weight, total Engine, lb.	120,000	419,310	258,000	457,500
Tractive Force, lb.	23,300	75,000	66,200	82,500

* Cylinders are compound; one high-pressure inside, two low-pressure outside.
** Water-tube firebox, with heating surface of 772 square feet.

THREE-CYLINDER LOCOMOTIVES (BRITISH)

Road	Date	Type	Cylinders in.	Drivers diam., in.	Steam Press. lb.	Grate Area, sq. ft.	Water H't'g. Surf., sq. ft.	Super-H't'g. Surf., sq. ft.	Wt. on Drivers lb.	Wt., total Engine lb.	Tractive Force, lb.
London & North West.	1884	2-4-0*	Two H. P. (O.S.) 14x24 One L. P. (I.S.) 30x24	75	175	20.5	1402	——	67,200	95,200	16,800
Midland	1901	4-4-0	One H. P. (I.S.) 19x26 Two L. P. (O.S.) 21x26	84	195	26.0	1720	——	87,300	133,400	21,820
Midland	1905	4-4-0	One H. P. (I.S.) 19x26 Two L. P. (O.S.) 21x26	84	220	28.4	1473	——	87,600	134,200	21,900
Midland	1924	4-4-0	One H. P. (I.S.) 19¾x26 Two L. P. (O.S.) 21¾x26	81	200	28.4	1321	360		138,000	
Great Central	1905	4-4-2	One H. P. (I.S.) 19x26 Two L. P. (O.S.) 21x26	81	200	26.0	1931	——	82,900	159,000	20,720
Great Eastern	1902	0-10-0T	18½x24	54	200	42.0	3010	——	179,200	179,200	38,900
Great Central	1907	0-8-4T	18x26	56	200		1931	——	165,700	216,500	38,500
North Eastern	1909	4-8-0T	18x26	55¼	175		1310	——	149,500	189,500	34,000
North Eastern	1910	4-6-2T	16½x26	55¼	180		1648	——	124,500	195,600	29,400
North Eastern	1913	4-4-4T	16½x26	69	160	23.0	1059	273	89,200	189,800	21,000
North Eastern	1911	4-4-2	16½x26	82	160	27.0	1476	530		172,800	17,650
North Eastern	1919	4-6-0	18½x26	68	180	27.0	1564	530	131,500	174,000	30,100
North Eastern	1919	0-8-0	18½x26	55¼	180	27.0	1564	530	160,300	160,300	37,000
Great Northern	1920	2-6-0	18½x26	68	180	28.0	1911	527	134,400	160,800	30,100
Caledonian	1921	4-6-0	18½x26	73	180	28.0	2370	270	134,400	181,500	28,000
Great Northern	1921	2-8-0	18½x26	56	180	27.5	2032	431	150,800	169,900	36,500
Great Northern	1922	4-6-2	20x26	80	180	41.2	2930	525	134,400	207,000	29,900
North Eastern	1922	4-6-2	19x26	80	200	41.0	2422	696	134,400	217,000	30,000
London & North East.	1925	2-8-2	20x26	62	180	41.2	2930	525	160,000	224,000	38,500
London, Mid. & Scot.	1927	4-6-0	18x26	81	250	31.2	2081	445	140,000	190,200	33,150
London & North East.	1934	2-8-2	21x26	74	220	50.0	2714	636	180,540	246,960	43,460
London & N. East.**	1935	4-6-2	18½x26	80	250	41.2	2576	749	147,840	230,600	35,450

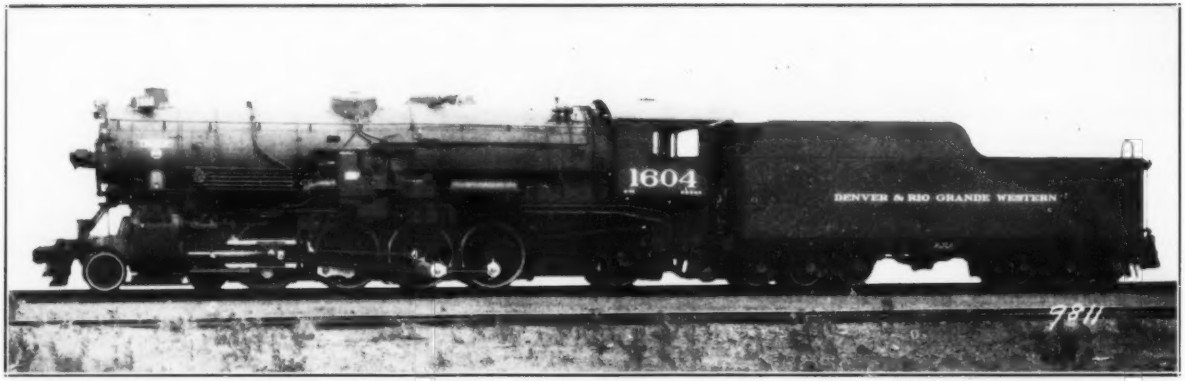
The letter T in Type column indicates a tank locomotive.

* The dimensions given apply to the group of Webb compound locomotives known as the "Dreadnought" class. There were several designs of Webb compounds, differing somewhat in details and dimensions. The Pennsylvania locomotive No. 1320, built in 1889, belonged to the "Dreadnought" class. The two pairs of driving wheels were independent of each other, no coupling rods being used.

** This locomotive is fully stream-lined.

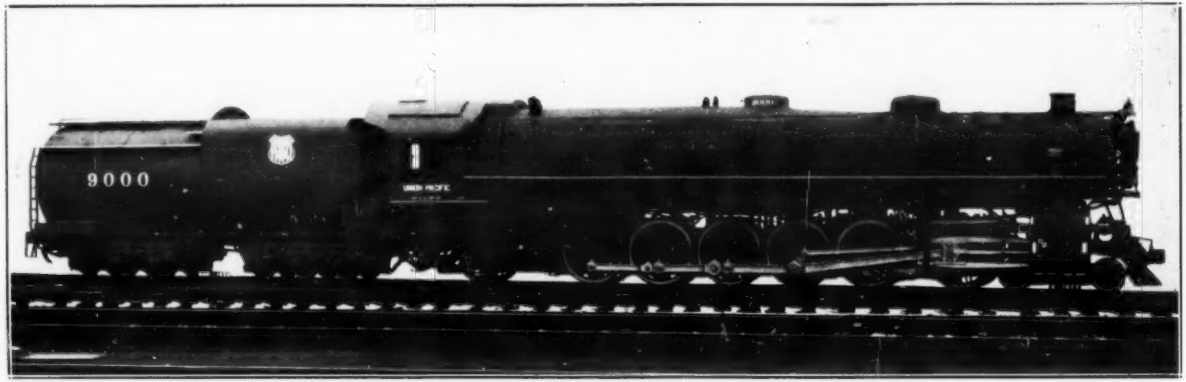
Tractive forces of compound locomotives are based on 25% adhesion; of single-expansion locomotives, on 85% mean effective pressure.

pressure.



—Courtesy of Baldwin Locomotive Works.

D. & R. G. W. #1604—Baldwin 1926—Three Cylinders, 25"x30"



—Courtesy of American Locomotive Company.

U. P. #9000—A. L. Co. 1926—Three Cylinders 27"x31"x32"

U. P. #9000—A. L. Co. 1926—Three Cylinders 27"x31"x32" —Courtesy of American Locomotive Company.

THREE-CYLINDER LOCOMOTIVES (DOMESTIC)

BUILT BY AMERICAN LOCOMOTIVE COMPANY

Road	Date	Type	Cyls. in.	Drvs. diam. in.	Steam Press. lb.	Grate Area, sq. ft.	Water H't'g. Surf., sq. ft.	Super H't'g. Surf., sq. ft.	Wt. on. Drivers, lb.	Wt. total Engine, lb.	Cyln. Tractive Force, lb.	Booster Tractive Force, lb.
N. Y., New Haven & Hartford	1924	0-8-0	22x28	57	200	56.1	3071	740	245,500	245,500	60,600	
Louisville & Nashville	1924	2-8-2	(1)23x28 (2)23x32	63	200	70.3	4304	1050	245,500	334,000	65,700	
Missouri Pacific	1925	2-8-2	(1)23x28 (2)23x32	63	200	66.8	3800	1051	244,500	340,000	65,700	
Wabash	1925	2-8-2	(1)23x28 (2)23x32	64	200	70.3	4224	1079	252,000	342,000	64,600	
Chicago, Rock Is. & Pacific	1924	4-6-2	22½x28	74	190	66.8	3527	933	187,000	301,000	46,400	
Missouri Pacific	1925	4-6-2	22½x28	73	190	66.8	3624	1030	191,000	311,000	47,200	
Louisville & Nashville	1925	4-6-2	22½x28	73	190	66.8	3435	933	177,000	295,000	47,000	
New York Central	1922	4-8-2	25x28	69	200	66.8	4430	1212	254,000	367,500	64,700	11,000
Lehigh Valley	1923	4-8-2	25x28	69	200	84.3	4729	1294	246,500	369,000	64,700	
Del., Lackawanna & Western	1925	4-8-2	25x28	73	200	80.0	4982	1290	256,000	382,000	61,100	
Del., Lackawanna & Western	1927	4-8-2	(1)25x28 (2)25x32	63	200	80.0	5010	1292	276,500	397,500	77,600	10,220
N. Y., New Haven & Hartford	1927	4-8-2	22x30	69	265	70.8	4085	1756	260,000	379,000	71,000	
Southern Pacific	1925	4-10-2	(1)25x28 (2)25x32	63½	225	89.6	5676	1500	316,000	442,000	83,500	12,200
Union Pacific	1925	4-10-2	(1)25x28 (2)25x30	63	210	84.0	5522	1505	288,500	405,000	78,000	
Union Pacific	1926	4-12-2	(1)27x31 (2)27x32	67	220	106.2	5853	2560	355,000	495,000	96,650	

The Chesapeake Beach Railway

By Hugh G. Boutell

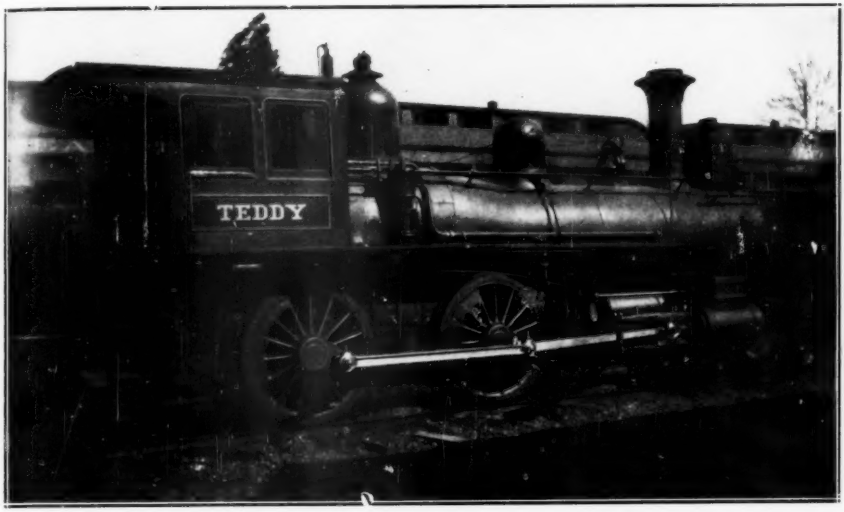
Statesmen, diplomats, the Army and Navy, Civil Service employees, and private citizens have always agreed on one thing—that Washington, the Nation's capital, has a tough climate in the summer time. It isn't so bad today, because most of the public buildings, stores, theatres, hotels, and even some private residences are air-conditioned, but until comparatively recent times, a summer in the District of Columbia was something to be dreaded.

As soon as Congress adjourned or school let out, the wealthier residents left for the Blue Ridge or Allegheny Mountains, Atlantic City, New England, the Thousand Islands, or more distant resorts, but many people had neither the time nor the money to go so far away. Yet, in retrospect, it wasn't all misery. Before the days of automobiles, say in the early 1900's, on a hot summer evening the family would take a ride on an open street car down to the Seventh Street wharves or out to Glen Echo or Chevy Chase Lake. The younger members might board the "Charles Macalester" for a "moonlight" to Marshall Hall or go canoeing on the Potomac or the C. and O. canal. And on at least one weekend—the highlight of the season—the whole family went to Chesapeake Beach!

Although Washington is only 25 miles from salt water by air line, the Bay was quite inaccessible 50 years ago. One could go to Annapolis via the B. and O. or Pennsylvania Railroads and the Annapolis, Washington and Baltimore, or down the Potomac by steamer, but no direct line existed from the District of Columbia to the Chesapeake. To anyone acquainted with Washington it must have seemed obvious that a railroad between the Capital City and the sandy shores of Chesapeake Bay would meet a real need, and should bring in a handsome return. There would be all the summer passenger business (salt-water bathing was a real novelty to many people in the early nineties) and considerable freight to be moved to and from a good farming country during most of the year.

It was with high hopes, therefore, that the Washington and Chesapeake Beach Railroad Company was chartered under the laws of Maryland, September 1, 1891. Its principal backers were Edwin Warfield of Baltimore—banker and statesman, and later Governor of Maryland, and J. L. Barbour of Washington. The latter was prominent in business circles. He had developed the subdivisions of Columbia Heights and Ledroit Park, and the firm of which he was the head, held the contract for paving the streets of the Capital with asphalt.

The financial operations of the W. and C. B. R. R. Co. do not appear to be of record, but it seems probable that neither Warfield nor Barbour was willing to go very far personally in support of the project, because although the company proceeded promptly with surveys and the purchase of land, it was soon in financial difficulties. An attempt was made



Chesapeake Beach Railway 8-wheeler No. 1, named TEDDY. Formerly P. R. R. No. 5135. Old Class A-anthracite, new class D-7-a, built at Altoona in 1888. Photographed at Maryland Park yard in February, 1909.

A six-car excursion train hauled by C. B. Ry. 8-wheeler No. 2, photographed at full speed near Upper Marlboro, Md., May 30, 1920. On Sundays and holidays in the summer time three or four such trains would leave Washington with only a few minutes between them.

to interview almost every Government employee in Washington in the hope of selling stock in an enterprise so obviously to the advantage of that particular group, but the effort met with but little success. Perhaps people were skeptical. At any rate, no actual construction was ever started, and the plan languished for over four years.

Just as this first enterprise seemed certain to collapse, a new figure appeared on the scene in the person of Mr. Otto Mears of Colorado. This gentleman was a promoter and railroad builder who had constructed two or three short narrow gauge roads in his native State to serve the southwestern mining districts. The Silverton Northern is one of the few remaining links in a considerable system which he once controlled, and Mears Junction on the D. and R. G. W. is named for him.

The panic of 1893 had brought business almost to a standstill at the mines; Colorado was in a bad way, and Mears suffered heavy financial losses. However, he was never a man to give up. He came east, and while in Washington, decided that he could succeed with the Chesapeake Beach scheme, even though others had been unable to put it across. Moreover, he had an original idea as to how this might be done. He wasn't interested in an ordinary picnic place frequented by Government clerks, or even in opening up a somewhat inaccessible farming district. He envisioned an American Monte Carlo on the shores of Chesapeake Bay where high officials of the Government could spend their hard-earned salaries, and with a first-class railroad giving direct service to the Capital. He succeeded in interesting David H. Moffat of Denver, one of the wealthiest men in Colorado in his plan. Thus, at the very beginning of the road's history, the usual precedents were reversed—western capital was to back an eastern railroad! So, when the Washington and Chesapeake Beach Co. defaulted in payment of interest on its obligations, and the property was put up at a foreclosure sale on December 10, 1895, it was bought by Robert E. Tod of New York, representing the Moffat interests.

On March 7, 1896 a new charter was granted by the State of Maryland, this time to the Chesapeake Beach Railway Company, the majority of the stock in which was held by Moffat. Certain provisions in this charter Mears believed fully authorized him to conduct, free from interference, a wide-open gambling resort at the terminus of his proposed railroad. He afterwards found that the police power of Maryland had not been surrendered, so all this part of his plan had to be abandoned.

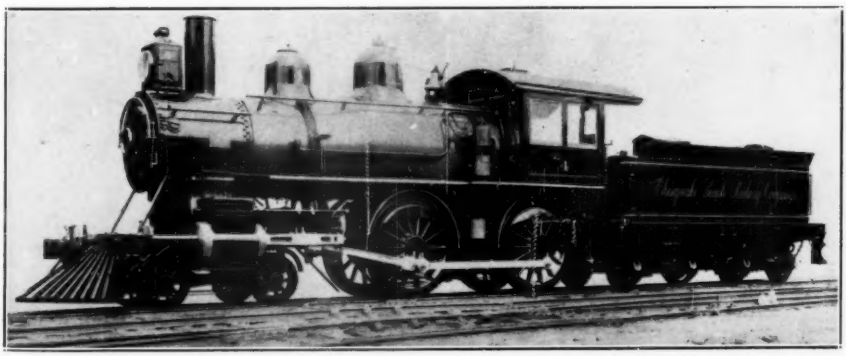
Nevertheless, Mears pushed ahead with the railroad. Another corporation was set up, known as the Chesapeake Beach Construction Company, and a contract was entered into by the railroad and the construction companies for building and equipping about 28 miles of track from a connection with the Baltimore and Ohio Railroad in the District of Columbia to a point on Chesapeake Bay at the mouth of Fisher's Creek. The construction company was to receive $30,000 in capital stock and $30,000 in first mortgage bonds of the Chesapeake Beach Railway Co. for each mile completed, in five sections, the entire road to be finished by July 1, 1898.

Actually, this construction company consisted of three men: Otto Mears, Charles Popper, and Ambrose C. Dunn. Apparently the three were constantly "at outs," or at least, Dunn was in disagreement with the other two, so that on the date set for the completion of the job only 10 miles of track, from the District line to Upper Marlboro, Md. were finished and in operation. On October 7, 1898 the contract between the two companies was canceled. Under the terms of the cancellation agreement, all that portion of the road that was completed and all that in course of construction, with all materials, supplies, and the construction company's outfit were turned over to the railroad company, which completed the road with its own forces and commenced operation on July 1, 1899.

If we search for the news of those days in the yellowing files of the Washington "*Evening Star*" to find some account of an opening ceremony, we will learn that on July third, the President and Mrs. McKinley were about to leave the city for the summer; Captain Dreyfuss had been brought back to France after his long imprisonment on Devil's Island; Aguinaldo was annoying the American forces in the Philippines, from whence Admiral Dewey was soon to return and be given a stupendous reception; the wife of a prominent naval officer had been burned to death by a gasoline explosion (a dangerous material, used in this instance for cleaning rugs) at her home on Nineteenth St.; Mrs. E. D. E. N. Southworth, popular authoress of "Capitola's Peril," had died at her home in Georgetown—and that, instead of speeches and brass bands to inaugurate Washington's new railroad, the Court Notices give the only reference, a note to the effect that Ambrose C. Dunn, as vice-president of the Chesapeake Beach Construction Co., had brought suit in the Supreme Court of the District of Columbia against his partners, Mears and Popper. He asked for the appointment of a temporary receiver for the construction company pending dissolution of the partnership, and demanded an accounting.

Dunn stated that from August, 1897 till January, 1899 he had lived along the line of the new railroad, and, being an experienced engineer, had superintended the construction work and endeavored to fulfill his obligations as a partner. But he had been antagonized by Mears and Popper, and complained that "they had overruled his directions and remonstrances, so that the work is defective and unsafe, and the trestles and culverts will have to be rebuilt." He also stated that "the engineers of the War Department have condemned the placing of a long and expensive bridge over the Patuxent." He ended by charging that Mears and Popper "by wasteful, inexperienced and careless management" had thrown away thousands of dollars, and had conspired to deprive him of his share in the control and management of the property, and his share of the profits." How this matter was settled we do not know, but the fact of interest to us is that in spite of these disagreements, financial difficulties, and publicity of a decidedly undesirable kind, the road had been completed after a fashion, and trains had begun to run.

Chesapeake Beach Railway 8-wheeler No. 3, showing the distinctive Pennsylvania cab and other features.



Chesapeake Beach Railway 8-wheeler No. 4. One of the three locomotives built new for the road by the Pittsburgh Locomotive Works in May, 1899.

To obtain the vital connection with the Baltimore and Ohio Railroad it was necessary for the Chesapeake Beach Ry. to operate for a little over two miles within the District of Columbia. A short length of track which met this need already existed. It belonged to what had been originally known as the Southern Maryland Railroad Co., later reorganized as the Washington, Potomac and Chesapeake Railroad, and still later as the Washington, Brandywine and Point Lookout. The first company, which had been chartered as far back as 1868, planned to build a railroad from the City of Washington to Point Lookout at the tip of the peninsula formed by the Potomac River and Chesapeake Bay. Construction was started in two sections—one from a connection with the B. & O. Railroad in the District of Columbia to the Maryland line, and the other from Brandywine station on the Popes Creek branch of the Pennsylvania, south to Mechanicsville, Md. The two sections were never joined, and the short length of track within the D. C. limits had never actually been used; in fact, it might be said to have been abandoned. The Chesapeake Beach Ry. apparently entered into an informal agreement with the Washington, Potomac and Chesapeake to use this piece of track without paying for it, regarding it as owned property. Finally the legal owner sued for possession, which brought about an agreement of lease, under the terms of which the C. B. Ry. Co. paid the taxes and maintained the track, besides paying $50 per year as rental. This agreement lasted from July 1, 1911 to February 1, 1915, when a new lease was entered into, the rent having been increased to $500 per year. In 1918, when the Washington, Potomac and Chesapeake went through its final reorganization, this short piece of track was purchased outright by the Chesapeake Beach Ry. Co.

Thus, as finally completed, the Chesapeake Beach Railway consisted of a single track steam railroad which connected with the Alexandria branch of the Baltimore and Ohio at Deanewood, D. C., reached the D. C.-Maryland line at Seat Pleasant, Md. and then ran in a general south-easterly direction to Chesapeake Bay. As reported for valuation purposes in 1916, the main line in the District of Columbia was 2.047 miles long, while the mileage in Maryland was 26.482, giving a total length of main line of 28.529 miles. Sidings and yard tracks totaled 5.834 miles, or a length of main, siding, and yard tracks of 34.363 miles. At that time the investment in the road, equipment, and land was stated to be $2,567,231.80. The officers during the first year or two of operation were: Otto Mears, president and general manager; John L. McNeil, vice president and treasurer; A. H. Servis, auditor and general freight and passenger agent; Fred W. Moffat, secretary; W. A. Beerbower, superintendent and chief engineer; and C. F. Winn, master mechanic.

It is obvious that the road had been hastily constructed and was not very well built. It followed the contour of the land too closely to secure good operating gradients, and while some 80 and 85 pound rail had been laid, that at the southeastern end was considerably lighter—too light for heavy equipment. There were several short bridges and the lengthy structure across the Patuxent River at Mount Calvert. The approaches

to this bridge were timber trestles, while the navigable channel was crossed by a steel draw span. Stations and other buildings, to say the least, were not elaborate. The stations at Seat Pleasant, Pennsylvania Junction, and Chesapeake Beach were the most important, but in all, there were 19 station stops along the road, and the running time for local trains (two each way per day) was an hour and a quarter. Excursion trains, which made only half a dozen stops, often made the run in less than one hour. Operation of trains was by time table and telephone orders. Seven passing sidings made it possible, when business was heavy, to despatch trains as frequently as every 20 minutes in both directions.

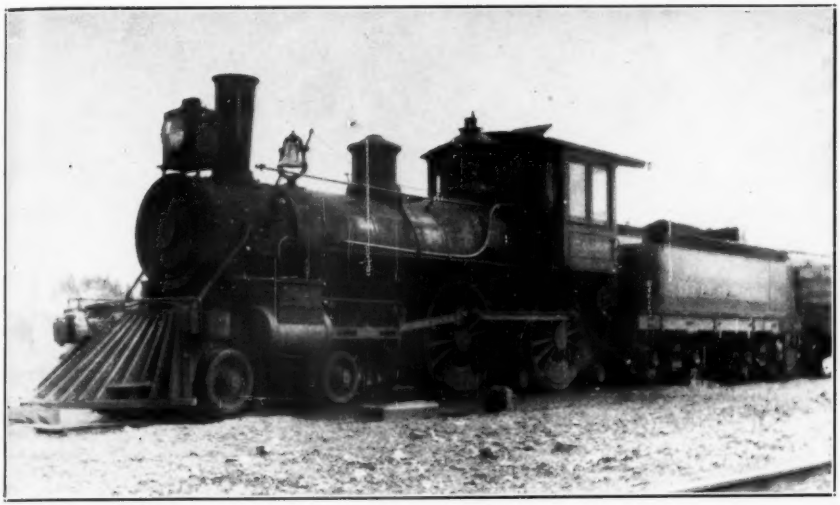
At the Beach, the facilities, in addition to the station with its long wooden platform, consisted of a water tank, sidings, and a "Y" for turning the engines. This "Y" was built over the marshes which occupy the level stretch between the water front and the higher country a mile or so inland. They were a breeding place for mosquitoes till oil was used to discourage the pests.

At Seat Pleasant, or as it began to be called "Chesapeake Junction," both the electric cars of the Washington Ry. and Electric Co. and the C. B. Ry. trains used the station. A long storage track for coaches was also provided,

The principal yard, with roundhouse and shops, was located about ¾ of a mile from the Junction at what is now known as Maryland Park. The brick roundhouse had five stalls and contained a reasonably good assortment of machine tools, driven by an electric motor. There was a 65 ft. steel turn table and a large water tank. In addition, a long wooden building containing two tracks was used as a car repair and paint shop.

On the completion of the road, an amusement park was built along the shore of Chesapeake Bay, principally south of the station. A boardwalk followed the line of the beach, and a long pier was built to the steamer channel, which at this point is half a mile or more from shore. An electric street railway was built, and during the season open cars ran from Chesapeake Beach to a small settlement which later grew into the town of North Chesapeake Beach. Although Mr. Mears' idea of a Monte Carlo never materialized, the Beach soon became popular with Washingtonians. It boasted a stretch of "fenced in" water, free from sea nettles, a large hotel, and many concessions. Even a race track existed there for a short time, and to this day a miniature railroad runs the length of the long pier, but its little steam locomotive has been replaced by a crude imitation driven by a gasoline engine. The Beach was a favorite objective for outings of fraternal organizations and the like, so that very soon after it opened, the railroad was doing a sizable excursion business. In 1902, for instance, the passenger traffic accounted for 82 per cent of the road's gross receipts.

It is, therefore, easy to understand why the Interstate Commerce Commission's valuation report in 1916 lists only one freight car as belonging to the road, while it owned or leased 24 passenger cars, five work cars, and one private car.



The old 8-wheeler belonging to Mr. J. T. Andrew of Montgomery, Ala. This engine was used on the tracks of the C. B. Ry. to demonstrate Mr. Andrew's patented wheels for eliminating the dangers of derailments. Photographed in December, 1911.

One of the original Saint Charles Car Co's. coaches, rebuilt as the chair car "Dolores." Western and Spanish War influences were reflected in the C. B. Ry's. names for its equipment.

In spite of, at least, the moderate success that can be claimed for the undertaking in its early days, Otto Mears did not remain as head of the company for long. When business in the west improved he returned to Colorado, and died in California in 1928.

During 1905 and '06 the presidency was held by Syl. T. Smith of Chicago, with A. C. Ridgway of Denver as vice president. It was at about this time that Mr. W. J. Hayward became superintendent and master mechanic. He remained with the road till its abandonment and died three years ago in Washington. He had much to do with keeping the equipment in excellent condition with limited means.

In 1907 Mr. William F. Jones of Denver, who was general traffic manager of Moffat's Denver, Northwestern and Pacific, became president of the Chesapeake Beach road, and he retained this position till 1933. He took a genuine interest in the property and its best years were during the early part of his administration.

Mr. Paul Y. Walters of Washington was also with the road in its early days and at one time served as secretary, acting treasurer, auditor, general manager, and traffic manager—enough jobs, one would guess, to keep any man busy.

While the control of the company was always in Colorado, the actual operation of the road was handled from Washington, much of the responsibility resting on the superintendent—the position held by Mr. Hayward for so many years.

Referring now to the road's equipment, it is impossible to trace the history of every piece of passenger rolling stock today, since all but three of the cars have been destroyed, and the records are not entirely clear. The equipment built for the road came from the Saint Charles Car Co., and is believed to have comprised 20 wooden coaches and two wooden combination mail and smoking cars. These were all 66 ft. long, and the coaches had a seating capacity of 80 passengers, while the combination cars held 30 passengers each. These cars had cane seats, open platforms, and oil lamps. Later, three of the coaches were rebuilt as chair cars in which seats could be reserved. They were named "Dolores," "Rico," and "Silverton." Early in its history, the road acquired, tradition says from some line in Colorado, two or three very short parlor cars and a private car, the last being used by Mr. Mears and later by Mr. Jones. The cars were built at the Buffalo shops of the Wagner Palace Car Co., and one of the parlor cars, named "Denver" when in service on the C. B. Ry., had on the inside of a closet door an equipment list made out in 1897 for the "Wagner Palace Car 'Utawanna.'" These cars were not much over 40 feet long and had a curious arrangement of windows. Beginning at the end of the car, there were four small windows, then one very large window, then two small ones in the middle of the car, another large window, and four more small ones. The cars had lightly built trucks and open platforms. The interior decorations were in the ornate style of the 80's.

The private car was named "San Juan" and was constructed along the same lines as the parlor cars except that the body was longer (about

42½ feet), and there were three, instead of two, small windows between the large ones. The car was handsomely fitted up with kitchen, staterooms, and observation room. The rear platform had elaborate railings, and the gas lamps had ornamental globes. Mr. Mears was fond of telling his friends that the car in which they were riding had been used by the great singer, Adelina Patti, during one of her tours of America.

The road, at various times, either bought or leased a number of other coaches, among which were ancient cars from the Pennsylvania, the Buffalo, New York and Philadelphia Railroad, and, doubtless, from other lines.

While the records, as regards locomotives, are reasonably complete, one point is in dispute. The books of the American Locomotive Co. show three engines as having been built new for the road, while the C. B. Ry's. own reports, and the writer's recollection is that only two were so built.

The two locomotives about which there is no dispute were built by the Pittsburgh Locomotive Works, and were delivered to the road in May, 1899. They were well-proportioned 8-wheelers with extended wagon-top boilers, 18x24 inch cylinders, 68 inch drivers, and weighed 55 tons. The finish was unusually good, and the lettering on the tank—"Chesapeake Beach Railway Company"— was in script, as on the tender of the famous "999." The road numbers of these engines were 4 and 5, and they were in service till the 1930's.

Engines 1 and 3 were small 8-wheelers that had originally belonged to the Pennsylvania Railroad, where their road numbers had been 5135 and 5116, respectively. Both were built at Altoona in 1888 and were classified as "A-anthracite" or new class "D-7a." They had 17x24 inch cylinders, 62 inch drivers, and long, narrow fireboxes for burning hard coal. They had the handsome P. R. R. ornamental cap stacks, round domes and sandboxes, the distinctive Pennsylvania cabs, headlights, and long wooden pilots. They were favorites on the road and were kept in fine condition. At first engine No. 1 bore the name "Teddy," while the 3 was named "Billy" (perhaps for the hero of San Juan and President McKinley), but about 1910 these names were removed from the cab panels.

Engine No. 2 was a Pittsburgh 8-wheeler, built in 1898 and similar in appearance to Nos. 4 and 5. She had the same size cylinders—18x24 inches, but was somewhat heavier, weighing 65 tons. She was in service up to the last year or two of the road's existence.

The No. 6 was an older and lighter Pittsburgh engine, also an 8-wheeler, but built in 1893. Her cylinders were 17x24 inches and she weighed 54 tons.

No. 7 was a 10-wheeler, originally built for the New York, Philadelphia and Norfolk by Baldwin in 1896, and numbered 14 on that road. She had 18x24 inch cylinders and 62 inch drivers, and like the 1 and 3, had many Pennsylvania characteristics. She was finally cut up for junk early in 1941.

Mr. Mears private car "San Juan" as it looks today. Minus its trucks, and with an "L" built onto one side, it is now the home of Mr. E. R. Marcus, engineer of the East Washington Railway, and his family. Photographed at Maryland Park in February, 1941.

Engine No. 8 was also a 10-wheeler, built by the Brooks Locomotive Works, and purchased by the C. B. Ry. from the Birmingham Rail and Locomotive Co., Birmingham, Ala., in 1921. The date when she was built is not known, but she had 18x24 inch cylinders and was of about the same size as No. 7.

Locomotives 9 and 10 were bought from the Western Maryland about 1931. They were Baldwin consolidations, built in 1901, and had 22x28 inch cylinders and 52 inch drivers. Their numbers on the W. M. had been 409 and 401, respectively, and they were of that road's class H-4. They were bought specially to haul construction materials for the improvement of the highway to Chesapeake Beach, a job that eventually had much to do with putting the railroad out of business. The financial difficulties in which the C. B. Ry. found itself a year or two after these engines were acquired led to their eventual return to the Western Maryland.

Engines 11 and 12 were small 8-wheelers bought from the Southern Iron and Equipment Co. of Birmingham, Ala., in 1933. They had been built by Baldwin for the Atlantic Coast Line in 1888 and 1890, where they bore the road numbers 132 and 141, respectively. Both of them had 18x24 inch cylinders and 63 inch drivers, and had been rebuilt with new boilers in 1926. These two locomotives are still in service on the East Washington Ry.

To understand the operation of the road's passenger business, as it was carried on 35 years ago, it is necessary to consider briefly the railroad layout in the vicinity of Washington at that time.

The B. & O. R. R. left the city (as it still does) by two routes, one aiming northeast to Baltimore and one northwest to Cumberland. The Pennsylvania then had only one line from the city, which crossed the Anacostia River or eastern branch of the Potomac on a long slant and then turned north toward Baltimore—a line now used only for freight. Just beyond the District line on the way to Baltimore, the B. & O. passes through the suburban town of Hyattsville. At the station in this place, a "Y" connects the main line with a single track branch that runs in a general southerly direction close to the old main line of the P. R. R. Below the point where the P. R. R. swings off to the southwest to cross the Anacostia River, the branch turns east and ends on the bank of the Potomac opposite Alexandria, Va. This lower terminus, now the site of the Bellevue research laboratories of the United States Navy, was then known as Shepherd's Landing, and a ferry carried freight cars from the B. & O's. wharf to the tracks of the Southern Ry. at Alexandria.

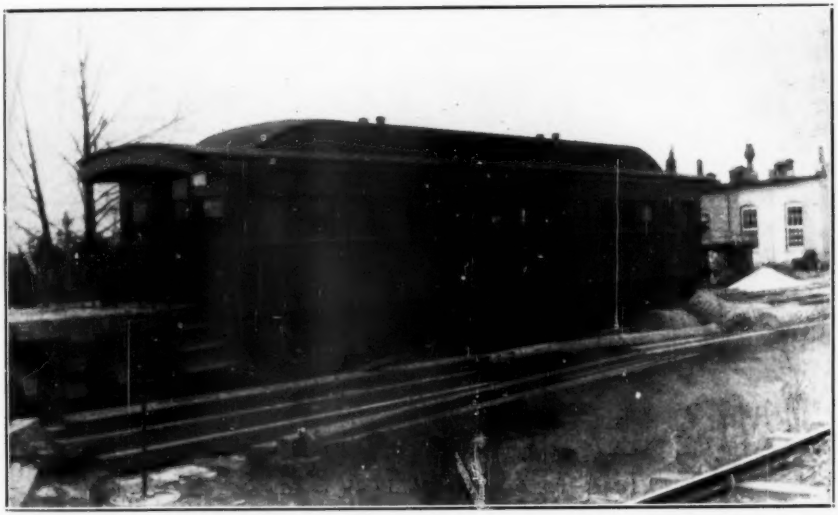
The Chesapeake Beach Ry's leased line in the District of Columbia connected with this Alexandria Branch of the B. & O. at Deanewood. This was about 2 miles west of the station at Seat Pleasant. Regular trains of the C. B. Ry. were operated from Hyattsville to Chesapeake Beach, using the B. & O's. Alexandria Branch from Hyattsville to Deanewood, and were turned on the "Y" at the former place. The road could, therefore, easily interchange traffic with the B. & O. and it would have been possible to operate C. B. Ry. trains into the old B. & O. station

at New Jersey Avenue, or after October 1907, into the Washington Union Station. It is believed that this was actually done on one or two special occasions. Likewise, C. B. Ry. locomotives could easily be sent to the B. & O's. Mt. Clare shops for heavy repairs, and this procedure was customarily followed.

For a short distance north of Deanewood the route followed by C. B. trains was therefore, parallel and close to the old main line of the P. R. R. The writer remembers riding on a passenger train from the Beach that was overtaken and passed by the northbound "Congressional Limited," her high-wheeled D-16 just gathering speed for the non-stop run to Baltimore. It would surprise many Washington "fans" to learn that they could once have recorded the "crack" trains of these two roads on a single negative!

The majority of passengers, however, did not get on the Chesapeake Beach Ry. trains at Hyattsville. They came by street car from downtown Washington, and changed to the railroad at Chesapeake Junction. On a pleasant Sunday morning in summer, crowds would arrive at the Junction, and several trains would be sent out close together. These pleasure-seekers who had paid only 50 cents for the round trip, would all return in the late afternoon and evening, and among them were always some who were decidedly the worse for their day at the Beach where salt water was not the only liquid available. Many wild tales are told of the last train back to Washington in the good old days when the crew would have their hands full in attempting to preserve the peace. Strings of fish and bags of crabs (25c was the charge for use of a crabnet, bait, steaming of the crabs, and delivery to you in a paper bag), empty lunch baskets, and beer bottles formed the baggage on a return trip, and rumor has it that a large and very wet fish was more than once slapped in the face of a conductor by an irate passenger who did not understand the necessity for giving up his ticket or paying a cash fare. The Congressional counterparts of the polished if slightly degenerate frequenters of the gaming tables at Monte Carlo—travellers in the parlor cars, as anticipated by Mr. Mears—needless to say, never materialized.

The freight business on the road, at first negligible, gradually increased and toward the end of the line's existence brought in more than the passenger traffic. It was this freight business that was important to the small communities along the line, for it enabled them to send their farm products and lumber to a market at low cost and with minimum delay. Freight was interchanged at Pennsylvania Junction, where the road crossed the Pope's Creek branch, but most of it went to the B. & O. at Deanewood. At all events, the B. & O. R. R. thought the C. B. Ry. was serving a sufficiently useful purpose to make the control of the line worth while, if it could be obtained at a reasonable price. On September 17, 1929 the B. & O. applied for authority to purchase the C. B. Ry. on the grounds that it "was among the short and weak lines connecting with its system, the continued operation of which is in the public interest and is a public convenience and necessity." No sale, however, was consummated.



Chesapeake Beach day coach No. 44. Originally built for the Buffalo, New York and Philadelphia Railroad. Photographed at Maryland Park in December, 1911, when the car was in use on a work train.

Another plan that came to nothing was that of establishing a ferry service between the terminus of the road at Chesapeake Beach and a point on Trippe's Bay, near Hudson, Md. The C. B. Ry. proposed to purchase two new automobile and passenger ferry boats, each with a capacity of 95 vehicles and 1000 passengers, and driven by two 1200 horsepower Diesel engines. A causeway 1250 feet long and 50 feet wide, with an open wharf 40 feet wide, was to replace the old wooden pier at the Beach, and similar facilities were to be provided at Trippe's Bay. But the Claiborne-Annapolis Ferry Co. opposed the plan, declaring that such a service was not needed. Moreover, the Interstate Commerce Commission, while granting permission to establish the ferry, pointed out that the railroad, itself, was hardly in a financial position to undertake any such elaborate scheme.

At various times rumors were current that the Chesapeake Beach Ry. was to be electrified, so that through cars could run from Fifteenth St. and New York Ave. in Washington, right to Chesapeake Bay. In those days the Washington, Baltimore and Annapolis Electric Ry. was, in fact, operating its cars over exactly this route from the center of the city to a point just west of Chesapeake Junction, where their line curved off to the north, crossing the C. B. Ry. at grade, so that very little realignment would have been necessary to connect the tracks of the two roads. But, judging by the fate of the W. B. & A. (which, by the way, was one of the best built interurban roads in the country), such a connection might actually have shortened the life of the Chesapeake Beach line.

So far as the writer remembers, the road, in spite of the predictions of Mr. Dunn, never had any serious accident. Minor derailments were rather frequent, and some patrons were fond of stating that the "whole outfit would drop into the Patuxent River one of these nights," but nothing like that ever happened. A few fatal collisions with automobiles are recorded, but as is generally the case, these were probably the fault of the drivers rather than of the engine men. But if the road was never the scene of any major railroad disaster, it was one on which "faked up" accidents were avoided by a hair's breadth.

The explanation is that for years the C. B. Ry. was a favorite line on which to try out all sorts of "improvements" designed to revolutionize railroading. During more than half the year the traffic was light, so that experiments could be conducted even on the main line without too much delay in the regular service. Then too this "railroad laboratory" was right at the back door of Congress and if it could not haul the legislators to an American Monte Carlo, it could at least secure their attendance at some demonstration through which an inventor hoped to secure the support of the Solons for his pet scheme.

For instance, about 1907-09 the American Signal Co. was trying out a system of cab signals and automatic stop, using the Chesapeake Beach Railway as their proving ground. The apparatus was installed on the two little 8-wheelers, Nos. 1 and 3, and when they were not hauling regular trains they were staging close escapes from head-on collisions. The signal company issued a circular describing their system which contained

an illustration showing two locomotives with pilots almost touching, headlights glaring at one another, steam roaring from the pop valves, and the crews congratulating themselves on their miraculous escape. The apparatus must, actually, have had considerable merit, for it is known to have operated satisfactorily in controlling the movements of trains. The idea however was ahead of its time, and was only revived many years later under pressure from the Interstate Commerce Commission.

Then, in 1911, the road made the newspaper headlines in the interests of a most spectacular scheme. Mr. J. T. Andrew of Montgomery, Alabama, was worried about derailments. He did not believe that jumping the track could be prevented, but he reasoned that most of the damage could be avoided if the derailed engine and cars could be kept upright and near the track and, above all, stopped quickly. He bought an old engine and baggage car and supplied them with extra sets of wheels. These were double-flanged, spool-like affairs inside and outside the regular wheels, and just clearing the rails. If the engine derailed she would drop on these "spools," the inside ones on one rail and the outside ones on the other, the motion of these wheels would apply the air brakes, and after rolling a short distance, the train would come to a stop with nobody hurt and no property damaged.

Mr. Andrew made arrangements with the C. B. Ry. to demonstrate his invention on their road. His train was brought north by his own engineer, W. T. Morris of Athens, Ga. and a colored fireman and machinist named Mack Mills. Two hundred demonstrations were staged, at speeds up to 40 miles per hour, but it was obvious that the scheme would work only if the break in the track was very short. It seemed more to the point to prevent derailments in the first place.

Mr. Andrew's engine was a small 8-wheeler from the Seaboard Air Line and had been rebuilt by the Withers Foundry and Machine Co. of Atlanta, Ga. She was not kept in the spick and span condition of the road's regular engines, and so far as is known, was never in regular service. After the demonstrations she lay on a siding near the round house for a long time, but what was her ultimate fate is not recorded.

The eventual abandonment of the Chesapeake Beach Ry. can be traced to the coming of automobiles and improved highways, and as neither of these was an overnight development, so the fortunes of the railroad gradually declined. But other factors entered into the picture. The popularity of resorts such as the Beach waned after the World War. A one day picnic park had to possess quite unusual attractions or the blasé youngsters of the 1920's would not go there. And for the heads of families, week-end and all summer cottages were more in demand. Such a colony was rapidly being built at North Beach, a short distance farther up the Bay. At first the hauling of cement, lumber, and other supplies for these building operations helped the railroad. Its freight business increased, even while the passenger traffic fell off. Instead of two regular daily passenger trains each way, with numerous excursions on Saturdays, Sundays, and holidays, a mixed train could handle the

The roundhouse and shops of the East Washington Ry., almost hidden among the trees. The view is from the Central Ave. bridge over the abandoned right-of-way of the C. B. Ry.

The station at Seat Pleasant, Md., as it looks today. This is now the headquarters of the East Washington Ry. The electric cars no longer cross the District line to reach the platform.

business. A succession of fires at the Beach, one of which destroyed the large hotel, were disasters from which the resort never recovered. Still, if you wanted to go to the Beach, the railroad was the best way to get there, because the highway beyond the Patuxent River was rough and dusty in dry weather and a sea of mud after a storm.

Then, in the early thirties, the rebuilding of the highway commenced. Once again, for a short time, the fortunes of the railroad seemed to brighten. Its recently acquired consolidation engines had all they could do to haul cement for the new road and for the bridge over the Patuxent. It was the bright sunset before the final night. With a smooth highway and a reliable automobile one could reach North Beach in far less time than the train required. People forgot about the railroad, and even the freight began to travel by truck.

A small gasoline car driven by a Model T Ford engine was built to carry the mail, and steam passenger service was abandoned. The company could not meet its obligations and efforts to secure a Federal loan met with no success. Some say that Maryland politics, headed by interests unfavorable to the railroad, were involved in this, but the depression was taking its toll of short lines all over the country, so that financial assistance probably would merely have delayed the final catastrophe. On January 9, 1935, C. R. Webber was appointed Receiver and on March 9 of that year permission was granted by the Interstate Commerce Commission to abandon all that portion of the road from a point at the northern boundary of Central Ave. in Maryland Park (the end of the yard) to Chesapeake Beach, a distance of 25.629 miles. From statements of former employees of the company, it appears that the final decision to pull up the track was reached rather suddenly. Be that as it may, a flat car was fitted with a hoisting engine and derrick for handling rails, and all that part of the line between Maryland Park and Chesapeake Beach was torn up during the summer of 1935. The best of the rail was sold for relaying purposes on plantation roads in Cuba. All but three of the passenger cars were sold for junk and burned, the metal work alone being salvaged. The cars not destroyed were the private car "San Juan," the chair car "Dolores," and one of the combined mail and smoking cars, No. 11.

The engines left were the 7, 11, and 12; all the others had been scrapped or sold by this time.

Still, the little road wasn't quite dead. The Moffat estate realized that some valuable customers were reached by the three miles of track which remained, among these being the large electric generating station of the Potomac Electric Power Co., on the shore of the Anacostia River. Coal for this plant had been handled by the B. & O. railroad under contract, but this business could be taken care of by the C. B. Ry. Co. or its successor after reorganization.

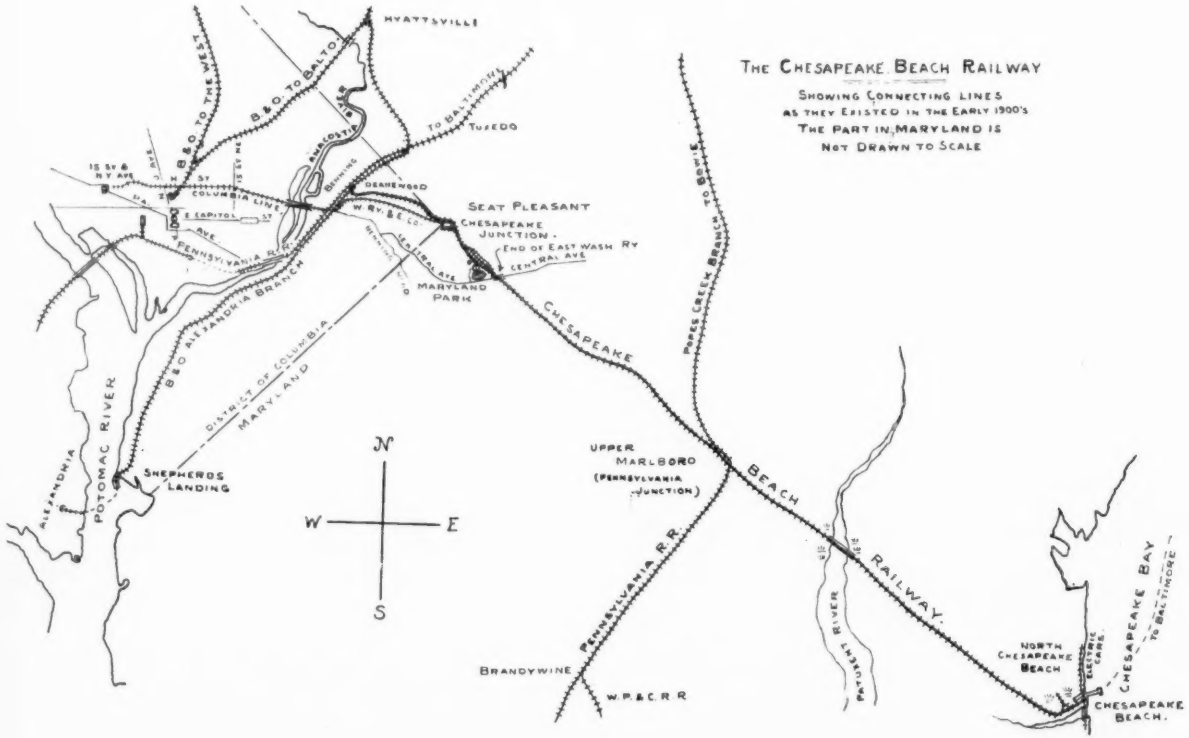
A new corporation was formed on September 20, 1935, known as the East Washington Ry. Co., with William V. Hodges of Denver and New York as president; J. M. Rector as vice president, general manager and treasurer; and R. H. Hart as secretary-auditor. This company, all

the stock of which was held by the Moffat estate, took over what was left of the Chesapeake Beach Ry., and settled down to the business of a short switching road, with the general offices of the company in the station building at Seat Pleasant. However, as the old C. B. Ry. was unusual, so the East Washington Ry. is far from the ordinary variety of terminal properties. It is a single track line with a station and engine house that might be in a country village miles from any city. In fact, in summer the old roundhouse is almost hidden by dense trees.

Two locomotives, 8-wheelers Nos. 11 and 12, are still in service, each being used for a month at a time. Mr. E. R. Marcus, the engineer, who has been with the road for 26 years, lives with his wife and three children in the private car "San Juan," now minus its trucks, and with a small "L" built out from one side. The observation platform with its elaborate iron grill work, is now the front porch. Inside, Mrs. Marcus keeps her home beautifully neat, and it is pleasant to imagine that the spirit of the incomparable Adelina may occasionally join the little circle to listen to her present day successors, for the family are fond of good music, and a radio is an important part of the establishment.

Each week day one of the little engines "whishes" out of the house, using care not to run over Mr. Marcus' two dogs that have grown up with the railroad and are constantly running between the wheels. After taking water from an improvised standpipe, for the big wooden tank has been dismantled, she backs down the 2¾ miles of track to the B. & O. connection where she picks up her cars and distributes them along the line. The engineer complains that he can "hardly work the water out of her before he is at the end of the run." Repairs are still made in the roundhouse, and mechanically these 51 and 53 year old locomotives are in good shape, but there isn't much money for fancy work. The paint shop still stands with the chair car "Dolores" inside, all her wicker chairs gone now, for she is used as a work car. The family of a colored man employed by the company live in the combination car. This, with the "rigger," and a couple of flat cars, a weed killer, and the remains of the gasoline "buggy," complete the roster of the equipment. But there is a whole sermon in that weed-killer and in the fresh paint on the sign—"Freight Service to and from All Points"—on the station at Seat Pleasant. Neither the road nor its employees have lost their pride or self-respect. May they never lose either!

In conclusion it seems appropriate to state that considerable difficulty has been encountered in preparing this article. Unfortunately no one appears to have been much interested in the Chesapeake Beach Railway during the years when accurate information about it would have been easy to obtain. The writer was acquainted with its engines and cars, but knew nothing of the legal vicissitudes of the corporation or its financial difficulties. Most of the employees have moved away or are no longer living, and many of the old records have been destroyed. My wife, Mary M. Boutell, has diligently searched such material as is available at the library of the Bureau of Railway Economics, the Library of Congress, and in the files of the Washington newspapers. Mr. William


THE CHESAPEAKE BEACH RAILWAY
SHOWING CONNECTING LINES
AS THEY EXISTED IN THE EARLY 1900's
THE PART IN MARYLAND IS
NOT DRAWN TO SCALE
HYATTSVILLE
B&O TO BALTO
B&O TO THE WEST
TO BALTIMORE
TUXEDO
ANACOSTIA
BRENTWOOD
DEANWOOD
SEAT PLEASANT
CHESAPEAKE JUNCTION
END OF EAST WASH RY
CENTRAL AVE
MARYLAND PARK
PENNSYLVANIA R.R.
B&O ALEXANDRIA BRANCH
POTOMAC RIVER
DISTRICT OF COLUMBIA
MARYLAND
ALEXANDRIA
SHEPHERDS LANDING
N
W
E
S
UPPER MARLBORO
(PENNSYLVANIA JUNCTION)
POPES CREEK BRANCH TO BOWIE
CHESAPEAKE BEACH RAILWAY
PATUXENT RIVER
BRANDYWINE
W.P.&C.R.R
NORTH CHESAPEAKE BEACH
CHESAPEAKE BAY
TO BALTIMORE
CHESAPEAKE BEACH.

V. Hodges, president of the East Washington Railway Company, Mr. J. M. Rector, vice president, and Mr. R. H. Hart, secretary and auditor, have courteously permitted an examination of the I. C. C. valuation reports, copies of which are on file at Seat Pleasant. Mr. E. R. Marcus, for many years an engineer on the road, has gladly given interesting details of operation. Dimensions and dates of building of the locomotives were supplied by Mr. H. J. Downes of the American Locomotive Company and Mr. Paul T. Warner of the Baldwin Locomotive Works. For many hours spent in constructively criticizing and in revising the draft of this article, the writer acknowledges his indebtedness to his daughter, Miss Suzette Boutell, of the American Council on Education.

The Prairie Du Chien Pontoon Bridge

By Alden E. Miller

Wisconsin Territory was organized with some 15,000 inhabitants on April 20, 1836. Rapid settlement of the southern portion began that year. On September 17, 1836, at a village meeting in Milwaukee, Solomon Juneau, Byron Kilbourn, Hans Crocker, Benjamin H. Edgerton, and eleven others were appointed a committee to circulate petitions and in other ways endeavor to carry out the object of the meeting—the construction of a railroad from Milwaukee to the Mississippi River. Although the idea was well received and Congress appropriated $2,000 for a survey, the panic of 1837, rivalry among towns and arguments over respective merits of waterways, highways, plank roads, and railways, prevented execution of the plan.

In 1845, one Asa Whitney and a party of surveyors found several promising routes between Milwaukee and the Mississippi and much enthusiasm was aroused. On February 11, 1847, Governor Henry Dodge approved a bill incorporating the first railroad in Wisconsin to take any definite action regarding its charter,—the *Milwaukee & Waukesha Rail Road Company*. This Company was granted the right to "locate and construct a single or double track railroad" between those towns, "to transport, take and carry property and persons upon the same, by the power and force of steam, of animals, or of any mechanical or other power, or of any combination of them." The Company was organized November 23, 1847, with Dr. L. W. Weeks as its President. Subscriptions were immediately taken, but money was scarce.

The charter of the M&W R. R. had been amended in 1848 to authorize the construction of a line to the Mississippi River. It was not until April 5, 1849 that the necessary amount of subscriptions was raised. On May 19th a Board of Directors was elected and Bryon Kilbourn was chosen President of the Company. Grading bids were called for in September of that year.

The name of the M&W RR Company was changed to *Milwaukee & Mississippi Rail Road* on Feb. 1, 1850. The line was constructed from Milwaukee to Elm Grove by end of the year. By November, five miles of track had been laid, to Wauwatosa. The M&M R. R. Station in Milwaukee, opened in 1850, was Wisconsin's first railroad station. The Waukesha Depot was also built that year and became the first home of the M&M R. R. It also was used as a freight house and warehouse. It was constructed of Waukesha lime stone and of huge, hand-hewn white oak timbers.

On Tuesday, Feb. 25, 1851, occurred the opening of the railroad line from Milwaukee to Waukesha. On that day a shrill blast of a locomotive whistle announced the opening for traffic of a railway line from Milwaukee to Waukesha, a distance of twenty miles. Notwithstanding all the prior enthusiasm however, it took the promoters of the railroad over

a year to get the necessary funds together to build the line from Milwaukee to Waukesha, and then only after indomitable energy and perseverance. The chief promoter of the enterprise was Byron Kilbourn, President and Chief Engineer of the Company. In less than two weeks after the opening to Waukesha he announced that the railroad is now being carried forward to Whitewater (30 miles).

Prospectors were interested in having a railroad west of Madison and no doubt were impatient over the M&M R. R. ever reaching Madison, hence the *Madison & Prairie du Chien Rail Road Company* was incorporated, March 24, 1852, to build between those towns. In the fall of 1852 the M&M R. R. was completed to Milton from Eagle, Wis. Earlier in the year the line from Waukesha to Eagle was constructed. The *Southern Wisconsin Rail Road Company*, chartered April 7, 1852, was authorized to build from Milton to the Mississippi River (in the interest of the M&M R. R. Co.). When the M&M R. R. reached Milton it was not authorized to go to Janesville, but under the charter of the Southern Wisconsin, a company was formed that built the 8 miles to Janesville by January, 1853. Under an amendment to its charter the M&M was authorized to build from Milton to the Mississippi and the Janesville branch was purchased and extended as far as Monroe, a total distance of 42 miles. Byron Kilbourn resigned as President at this time to promote another railroad.

The *Madison & Prairie du Chien Rail Road Company* wasn't left to its own destiny very long after it was incorporated for we find a consolidation formed May 24, 1853 with the *Milwaukee & Mississippi R. R.* to form a new Company known as the *Milwaukee & Mississippi Railroad Company*, re-incorporated as of this date, the M&PdC R. R. Company thus losing its identity. The line from Milton to Stoughton was completed this year and extended into Madison from Stoughton in 1854.

The attitude toward railroads in those days is clearly indicated by the following extract from an article written in 1855 for the *MILWAUKEE SENTINEL* by General Rufus King, its Editor. General King had just completed a trip over the territory between Milwaukee and Prairie du Chien through which the M&M R. R. Company was being constructed.

"The completion of this road, now distant not more than fourteen or sixteen months, will be a memorable event for our city and state. It has already trebled and quadrupled the value of the farming lands along its eastern and finished division, and increased by the same amount the taxable property of the state. Its extension to the Mississippi will accomplish the like result along the western half of the line and give to the farmers of Dane, Sauk, Iowa, Richland, Grant and Crawford counties a noble avenue to the metropolis and principal market of the state. It will confer upon our city still more striking benefits, bringing hither not only the travel and traffic from all counties within our state through which it runs, but extending its feelers up the Mississippi and gathering in from Iowa, Minnesota and northeastern Wisconsin rich harvest or business and golden returns of trade. Let our merchants and business

men, thank God and take courage, for the whole Northwest invites and will reward their ventures."

By an act of Legislature approved Feb. 17, 1855 the M&M R. R. Company was authorized to build from Milton through Janesville, Monroe, Shullsburg, to a point on the Mississippi River, thence down the river to a point opposite Dubuque and from first named point on the river north to Cassville, in Grant County. On Feb. 13, 1856 the M&M R. R. Company took over the Southern Wisconsin R. R. Company and its property. The M&M R. R. was extended to Boscobel in 1856, the line having been constructed from Madison through Mazomanie, Lone Rock to Boscobel that year.

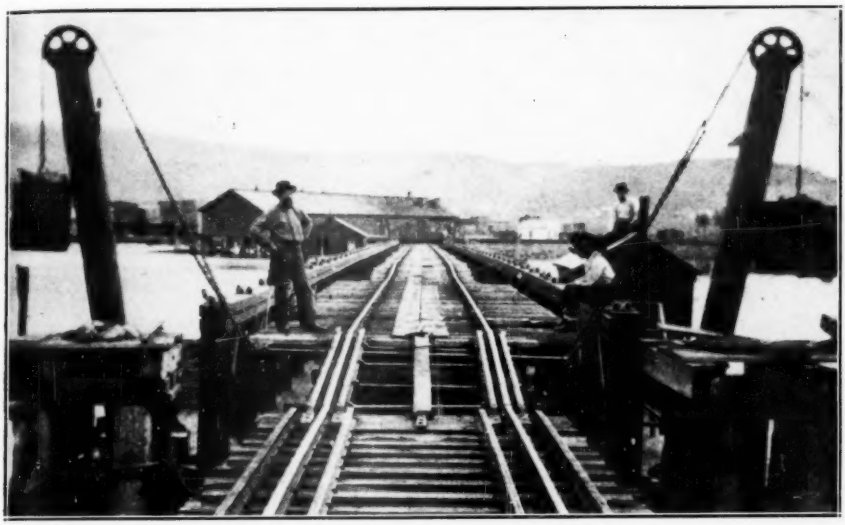
The Milwaukee & Mississippi R. R. reached the Mississippi River on April 14, 1857 after finishing construction of its line from Boscobel through Wauzeka to Prairie du Chien. The M&M R. R. had been six years in process of construction and was completed only in the spring of that year, the first passenger train reaching Prairie du Chien on April 14th. The depot, railroad yards and steamboat docks were located in lower town.

John Lawler, a native of Ireland, and who grew to manhood on this side of the Atlantic, entered railroading as a youth in the state of New York, an occupation then very new and untried. After several years experience in the east and two years in Chicago he became an employee of the new M&M R. R., the first railroad to cross the state of Wisconsin. He was appointed station agent at Prairie du Chien, arriving there to take up his duties on July 1, 1857. Mr. Lawler's appointment placed him in charge of an important post, second only to Milwaukee, as at this western terminus the railroad connected with a line of packets carrying mail, passengers and freight between Prairie du Chien and St. Paul.

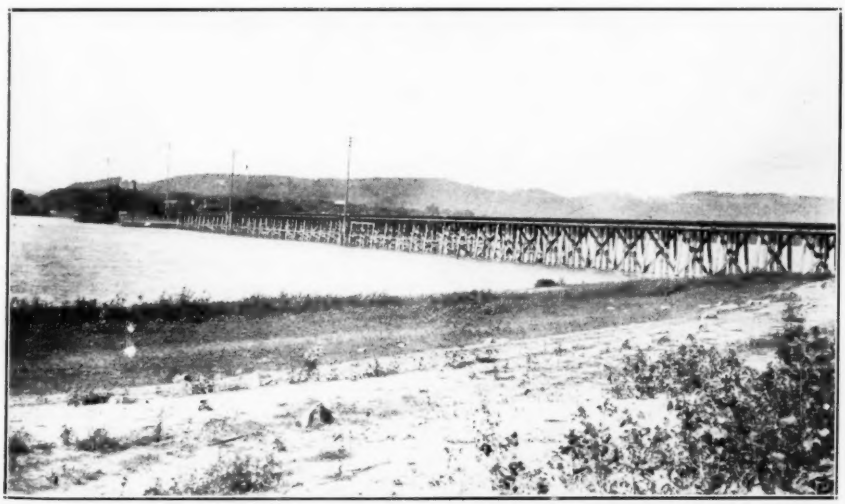
Up to this time St. Louis had been the one market for the entire Upper Mississippi and its tributaries. Now the M&M R. R. wished to divert commerce to the Great Lakes over their new railroad. The total length of the road was 194 miles. To get the iron horse and its train of cars across the two-mile gap between the Wisconsin and Iowa shores and on up into Minnesota was a problem.

Immediately upon completion of the road, thousands of immigrants swarmed to Prairie du Chien, intent on settling on the fertile lands of Minnesota, much advertised by the new railroad. Hundreds of families were detained at Prairie du Chien for days, waiting for steamers to take them up the river and trainloads of household goods, farm implements and livestock lined the levee, sometimes for weeks at a time, while the owners sought out homesteads further northwest.

In 1858 a fine hotel, the Brisbois House, was built in Prairie du Chien to accomodate the traveling public. In the autumn of 1859 the first shipment of grain from Minnesota to the Great Lakes was made by way of Prairie du Chien and Milwaukee, consisting of ten carloads of wheat. This event seemed so remarkable in the new country that congratulatory telegrams were received by the Milwaukee Chamber of Commerce. The "Lady Franklin," a boat built to run on water and ice,



View of Prairie du Chien's first Pontoon Bridge, built in 1874. Michael Spettel in foreground on left side of bridge, looking towards Wisconsin side with old Milwaukee & St. Paul R. R. properties in background.



One of the early pictures of the Pontoon Bridge at Prairie du Chien, Wis., designed by Michael Spettel.

was moved to Prairie du Chien on the M&M R. R. in 1859 and used for a short time for ferry service across the Mississippi River and north to Harper's Ferry. She was titled "Prairie du Chien & St. Paul (Milw. & Miss.) R. R. Line."

In 1859 and 1860 the M&M R. R. Company defaulted in payment of interest on its bonds. In the Civil War year, 1861, we find the M&M R. R. Company deeded, January 21st, to the *Milwaukee & Prairie du Chien Railway Company*. The M&M R. R. was actually offered for sale as of Jan. 18th, and on Jan. 21st the property was organized by purchasers who transferred the properties to the M&PdC Ry. Company. Benj. H. Edgerton was Engineer of the M&M R. R. up to the time of its sale to the M&PdC Ry. Company.

So highly satisfactory were the results secured by Mr. Lawler as station agent at Prairie du Chien for the M&M R. R. since 1857 that the reorganized M&PdC Ry. Company appointed him general agent of the new Company. By 1861 Prairie du Chien was shipping to Milwaukee a hundred carloads of grain daily. Business between Prairie du Chien and the Great Lakes flourished and increased but here was one serious obstacle to its extension westward and that was the unbridged Mississippi, a costly barrier between western prairies and eastern markets. Packet service in summer and teaming across the ice in winter was expensive and became entirely inadequate. In the spring of 1864 owing to the low stage of water in the Mississippi it became impossible for the larger steamers to reach the railroad dock on the bayou in lowertown, Prairie du Chien, and the railroad company established a new terminal on the river bank in the Fourth ward. A large railway yard was laid out, a grain elevator of 200,000 bushels capacity was erected.

On Dec. 31, 1867 the M&PdC Ry. Company was conveyed to the *Milwaukee & St. Paul Railway Company*. Earlier that year through service between Chicago and Minneapolis was provided by connections at Milwaukee by the Milwaukee & Chicago Railway and by the M&StP Ry. between North McGregor, Iowa (across from Prairie du Chien), by way of Calmer, Iowa northward to Minnesota, with the M&PdC Ry. as the connecting railroad.

A contract was made with John Lawler, in 1867, by the M&StP Ry. Company, for transportation of freight and passengers between Prairie du Chien and North McGregor (later Marquette). Transfer was made with steamboats. Since 1863 Lawler had been studying the Mississippi transfer problem, and his first attempt at solving it was the building of transfer barges or car ferries between Prairie du Chien and North McGregor. These barges carried four cars, one barge on each side of a steamer. These ferries were fitted with rails corresponding to the tracks on the banks of the river which were extended to the water's edge, so that cars were run directly from them onto the barges and were towed across by steam power. This method, of course, was only available during the season of navigation. From her home near the mouth of the Yellow River at North McGregor, Iowa, Mrs. Jacob Scrogum observed the transferring by steamboat and barge from Prairie du Chien. Household goods and farm implements were piled high on the Iowa shore as

well as covered wagons and stock. The authority and wisdom of the town marshall was often required to settle disputes between emigrants when selecting their property from the confused mass to start the next lap of their journey. In 1870, Lawler and his railroad transfer business at Prairie du Chien, in the winter season, cut a trench through the ice from shore to shore, and in this crude, dangerous and inadequate method attempted to transfer the loaded railroad cars.

After three seasons of transferring railroad cars across the Mississippi River in this manner, it was given up by Lawler as inadequate and unsatisfactory, even though a canal had been dug through an island to reduce the distance around by two-thirds, which was nearly two miles from shore to shore. A pile bridge was then built and the barges that had been towed by the steamers were used in the openings for steamer passage. This was treacherous, especially in windy weather and many a carload of wheat or farm machinery was rocked off the barges into the channel, making it expensive in damages, delay and obstruction to steamboats. In winter the gaps provided for the river traffic were filled in with piling.

The M&StP Railway, realizing the problem John Lawler had on his hands, and comforted by the fact that most of the traffic that had formerly gone by way of Prairie du Chien from Milwaukee to the Northwest was now diverted to their new main line from Chicago and Milwaukee via La Crosse to St. Paul, condescended to let Lawler have the franchise to transfer railroad business across the river at Prairie du Chien. Thus, on October 10, 1872, with himself as chief owner and executive, he incorporated the *Prairie du Chien & McGregor Railway Company* for the specific purpose of handling this railroad transfer business.

With John Lawler as President of the PdC&McG Ry. Company, a new line of boats was added to those already connected with the M&StP Ry. Co. Lawler started looking for some one to take him out of the dilemma. He consulted New York shipbuilders, who recommended Michael Spettel for his understanding of the science of buoyancy and knowledge of timbering watercraft and the use of swamp-oak rails, all of which had been lacking in former experiments. Spettel, in the meantime, had been persuaded to go to Prairie du Chien, by Joseph Reynolds, commonly known as "Diamond Joe," to supervise his steamboat construction on the Wisconsin and Mississippi rivers. Later he was engaged by John Lawler.

Spettel had five brothers, all of whom were shipbuilders in their father's plant, on the River Main, in Germany. Michael Spettel was born April 7, 1834 at Marktheidenfeld, Bavaria, Germany. He was married to Lena Ruhlman in St. Mary's Church, at Milwaukee, Wis. on Sept. 1, 1863. Mrs. Michael Spettel was born May 5, 1843 at Erie, Pa. M. Spettel died Dec. 25, 1915 at St. Paul, Minn. Ten children, one son and nine daughters, came from this marriage.

Lawler established Spettel in a shop on railroad property in Prairie du Chien, where Michael experimented with models in his effort to gain greatly needed facilities for transferring trains across the Mississippi river. The shop also served as a gathering place in the winter time for

villagers who were always ready to work a day or two as occasion might afford, as accidents were frequent. Children from nearby covered wagons would also come in to warm up, the assemblage sometimes so boisterous that Spettel would cease his activities to demand quiet. At that time he also struggled to master the English language under the tutorship of Wm. O'Neil, a stationary engineer engaged at the M&StP Ry. elevator in Prairie du Chien. These were memorable days in steamboat and railroad transportation with hundreds of covered wagons and trailing stock in sight from early spring until late in autumn waiting for means of reaching Iowa, Dakota and Minnesota, often fighting for a chance to board the ferryboat with a very limited capacity, which would enable them to continue on their weary way to the future homes, just where, they knew not.

Among those who enjoyed the warmth of Spettel's railroad shop was Mr. Gehem, a very old Canadian Frenchman, who would thrill the audience with recitals of his exploits as a mail carrier, as a young man during the winter seasons between Fort Crawford, at Prairie du Chien, and Ft. Snelling, near St. Paul. Also Mr. Gremore of Frenchtown, who claimed superiority among the trappers of that vicinity; and again the place would take on an aspect of solemnity in respect for Mr. B. W. Brisbois, reserved, tall, slender, erect and well advanced in years, who occasionally graced the place with his presence and dignified manner of reviewing his relations with John Jacob Astor's American Fur Trading Company, whose white stone storehouse and his own stately residence of white stone stood close by facing the railroad track and river. It was built by his father, Michael Brisbois, about 1814.

Lawler's chief trouble with his Prairie du Chien & McGregor Railway, as he called it, was getting on and off the ends of the barges with trains. The heavy engines would sink one end and tilt the other to a danger point. Numerous dry docking and calking made delay and expense. Mr. Lawler possessed no mechanical ability or engineering quality, and his several years of experiments resulted in failures and casualties. On July 15, 1873 the M&StP Ry. Co., commenced to operate the PdC&McG Ry. Company under contract, with John Lawler claiming the franchise.

After months of study on the needs required, Spettel, with ingenuity and intricate exertion, brought forth a model in all its details. It was accepted as abundantly adequate for the task the pontoon had to meet and hailed as a complete success. Lawler, up to this time, had had no knowledge of pontoon operation, hence the credit of having brought the pontoon to its final state of perfection belonged to Michael Spettel. General Humphrey, Chief of Engineers of the United States Army, examined Spettel's model and specifications and said: "The bridge in question is exceptionally free from obstruction as to navigation. It conforms to existing laws regulating the bridging of the Mississippi river, and affords excellent facilities for steamers and rafts to pass through the draw opening." Contract for the construction of the pontoon was let to Peter Conkee of Rock Island, Ill., with M. Spettel as

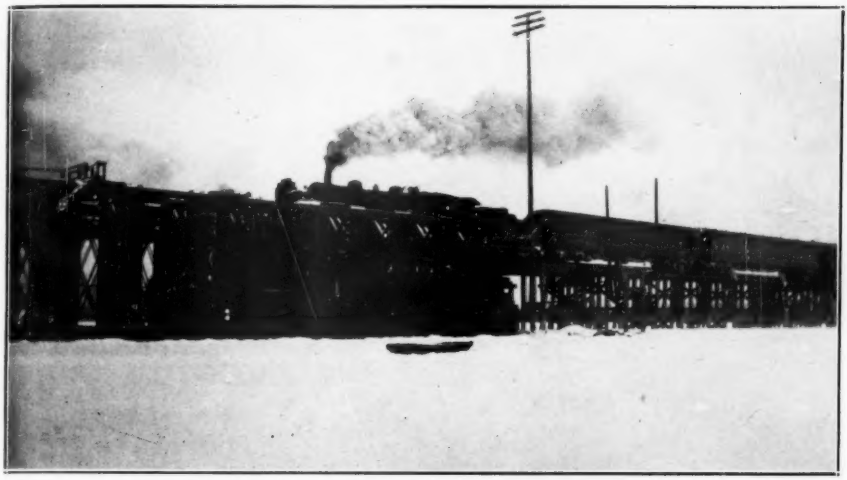
overseer. Changes made in Spettel's plans by Lawler were not only expensive, but failed to meet the desired end, and he finally decided that his interference delayed construction.

The model Spettel made with pen knives, eliminated low and high water approaches and did away with dry docking, while calking was done without interference to train movements. Buoyancy was taken care of, twenty feet from the ends of the pontoon, with aprons or girders and rails that form a part of the pontoon track, the outer ends of which rest on the pile approaches. This device brought the first bearing of a passing train twenty feet from the end of the pontoon hull and reduced submersion to only eighteen inches when the heaviest trains crossed. The structure Lawler built in early 1873, preceding the pontoon perfected by Spettel, was a permanent pile bridge with float draws for all season service. This was built at Lawler's own expense. The pontoon bridge at North McGregor became the largest and only one of its kind on the main channel of the river. Mr. Lawler furnished the money for the pontoon. He paid Michael Spettel $60 a month from the time he hired him in 1873 and on through the stages of the pontoon's perfection and construction and maintenance. In this interim Lawler made changes in Spettel's plans costing hundreds of dollars, yet these changes proved futile.

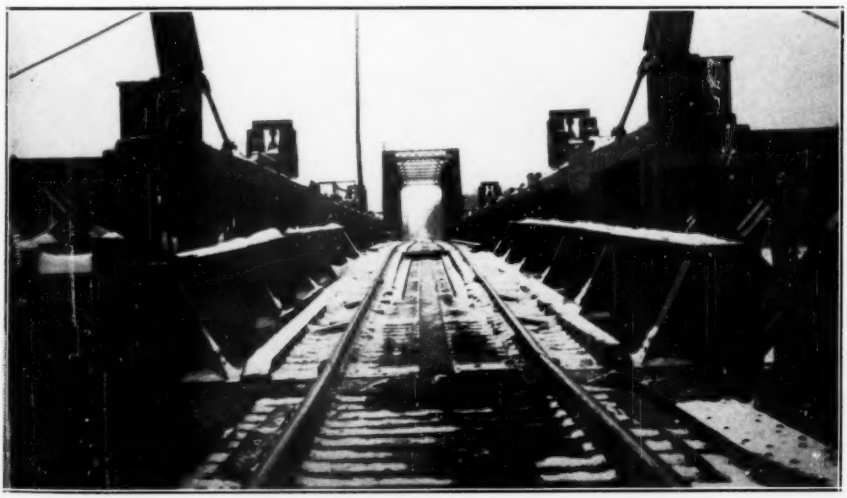
Spettel continued studying pontoon problems, made models and tried out ideas. He was so all-absorbed that he was irritable and sleepless, but he won, and on Wednesday, April 15, 1874, he saw his vision of victory come true, with Lawler, James Doyle, and Spettel himself, on the first train to cross the Mississippi on Spettel's pontoon, on board. Spettel might be called a pathetic figure in history, for although he actually invented the railroad pontoon bridge, yet, on August 11, 1874, John Lawler had patented, in his own name, (and so designated) the J. Lawler Floating Draw-Bridge. Lawler's purpose in having this perfection patented exclusively in his own name is probably best explained by the fact he realized this patent would extend to him sole rights, and the construction of the pontoon, with arrangements with the company for a toll of so much per car, would bring him a splendid income.

The Department of Commerce, United States Patent Office, Washington, D. C. Office records disclose the following patent issued to John Lawler:—U. S. Patent No. 154,055—issued August 11, 1874 to John Lawler, Prairie du Chien, Wisconsin for Floating Draw-Bridge. Leggett & Leggett, Attorneys. Witnesses, W. T. Newman and R. M. Barr.

The entire length of the bridge when first built was 8,000 feet, crossing both channels of the Mississippi and intervening island. The two original Mississippi pontoons provided a clearance of 409 feet each and offered facilities for the passage of 1,000 cars per day, the average then being about 300 a day, according to reports. John Lawler built a pile bridge from either shore of the river and across the island in midstream, with an opening for boats in such channel. Two huge pontoons operated by steam power swung out to permit the passage of boats or heavy runs of ice, and when closed formed a continuous bridge across



"Sioux Limited" crossing Pontoon Bridge at Prairie du Chien in 1936, the crack C. M. St. P. & P. Chicago-Sioux City flyer.



Spettel's Pontoon Bridge at Prairie du Chien as it looks today.

the river. Many objections were raised. Steamboat men contended that the pontoons would obstruct navigation and lumbermen declared no raft could be steered through the openings, but both were mistaken and the bridge proved a complete success.

The pontoon bridge had glorified the invention of Michael Spettel whose fertile brain and master mind conceived the famous buoyancy structure. Putting his ideas into concrete form in a model whittled from a wooden block with pen knives, went the successful operation in carrying trains across the river. Spettel's triumph attracted the attention of master builders and civil engineers the world over as one of the great inventions of the age. With the success of the pontoon, Prairie du Chien ceased to be a frontier town, as trains then passed over the Mississippi river to North McGregor and as much further as the railroad would extend.

During the time Mr. Spettel was employed by the Lawlers as a laborer. Sixty dollars per month was his only remuneration except for a short period when John Lawler, Jr., was in charge and gave him $15 per month extra in the hopes of holding his services. This was done against the wishes of the father, though John, Jr., recognized Spettel's right to the invention. Many well-meaning people loaned their influence toward giving Lawler credit for the pontoon invention because he was a man of means and a benefactor to the schools of his home town as well as other educational institutions and feared any credit given Spettel would result in withdrawal of further benefaction. Even the clergy of the church to which both families belonged refused to interfere.

The assertion concerning the invention of the pontoon which was generally accredited to Mr. Lawler was logical in the face of all revealing sentiment on the matter, but nevertheless deplorable that such a version of it should have found a place in history. That Lawler was a member of the American Society of Civil Engineers and that it was agreed that there must have been some qualifications to enable one to become a member of that organization, it must be realized Lawler was surrounded by an impenetrable social standing laying claim to this achievement—thus he would experience no trouble in acquiring such membership.

There were children in the Spettel home to care for and not a dollar in reserve as Spettel had put everything as time past on into his home. For him to show any resentment would have been foolhardy, especially as a strong undercurrent in pontoon affairs began to manifest itself at that time. Heartbroken, Spettel tried to assume an attitude of pleasure and satisfaction in the hope of a favorable change in the tide for which prayers and supplications were offered daily but to no avail. The goal had been set. The thorn that pricked most severely was the monthly wage paid M. Spettel the whole year even though there would be little to do some of the time and as the pontoon had reached a state of perfection that rendered his services dispensable it became apparent that he was no longer wanted. It is firmly believed that had a canvass been made in Crawford County while Lawler lived, hardly a person would have dared to express Spettel's due in the pontoon matter. To thus exercise

the freedom of one's conscience would have been considered a sacrilege, a sin against the most high, as the very name Lawler was shrouded in a sort of sacerdotal awe that barred challenge and question, all of which places the invention of the pontoon in a different and just aspect.

Records by the National Engineers' Association disclosed that John Lawler was only an honorary member of the Civil Engineers Society. Lawler received about three-quarters of a million dollars in royalties on his patent on the pontoon bridge. Spettel did not learn until many months later that Lawler had taken his model to Washington at the time J. D. Lawler applied for a patent. Being a poor man with a large family and unaccustomed to American ways, Spettel took promises of remuneration for granted, even though he personally supervised the pontoon's construction.

Lawler, who had been President of the PdC&MeG Ry. Company since 1872, died in Prairie du Chien, Feb. 24, 1891, and as the PdC&MeG Ry. had been operated under contract by the M&StP and its successor, the Chicago, Milwaukee & St. Paul since July 15, 1873, it was sold Oct. 18, 1894 to the CM&StP Ry. Co.

In 1903 the model of the pontoon bridge was on exhibition in the Field Museum, Chicago. It was sent to the St. Louis Exposition in 1904 and later to the Fairs at San Francisco and Seattle. At the close of the Louisiana Purchase Exposition at St. Louis, in 1904, the transportation exhibit loaned to the Exposition by the Field Museum, was turned over to the Baltimore & Ohio R. R. and stored at Martinsburg, W. Va. The transportation exhibits loaned by the Field Museum were not returned for the scope of the Field Museum was shortly confined to the natural sciences. Where this model of the pontoon bridge went and what its ultimate fate has been, we do not know.

The author of this article is indebted to the following sources and persons for their help in preparing this material:

"A Brief Record of the Development of the Milwaukee Road," by F. H. Johnson, 1935.
"The Railroads of Wisconsin, 1827-1937," by J. P. Kaysen.
"The Milwaukee (R. R.) Magazine."
"The Crawford County Press."
The State Historical Society of Wisconsin.
Mr. Wallace E. Martner, Editor of the former Prairie du Chien "Courier."
Mesdames Gertrude and Frances Spettel.
Mr. George Spettel.

Locomotive Builders of the United States

By Chas. E. Fisher

With this paper we are not concerned with the different designs of locomotives or the respective merits of the individual builder. Rather, we will attempt to discuss briefly the names of the different builders, their location and date of activities in so far as conditions will permit at this rather late day.

With the advent of the locomotive in this country, it found an agricultural nation sadly deficient in furnaces to make iron and machine shops and tools to make the finished product. It is true that labor was cheap. When however, we consider the difficulties they had of making the cranked axles, chipping the inside of the cylinders with hand, there was more than infinite patience but a grim determination to succeed and improve the method of construction.

As our members well know, the first engines were imported from England. The time needed to obtain repair parts from the English manufacturer gave rise to American ingenuity that he could do as well. The next step was that of construction and here American skill met its real test. Many faded out of the picture upon the completion of their first locomotive and these we will not discuss in this article. Panics, dissolution of partnerships and business failures have all played their part to reduce the number of active builders in this country to a very limited number. With the hundreds of new miles of track being built annually, new locomotive builders sprang into being. Once the demand was satisfied of a particular road only the strongest could survive the keen competition. Let us now turn to some of these individual builders commencing with those in New England.

There have been over a score of locomotive builders, at one time or another, in New England. Although some distance removed from the source of raw material, New England had the skilled labor. For a time this factor overshadowed the other but one by one the builders dropped from sight. Around 1880, a group of men from the different New England builders met at the Taunton Locomotive Works to discuss a consolidation of the builders. Here were found men from the Rhode Island, the Manchester and the Hinkley Works and possibly others. Yes, Mr. Mason from across the tracks was there also. Whether they could not agree upon a name for the concern or what the obstacles were, we do not know. Such a consolidation might have resulted in keeping one plant active in New England. It took New York to achieve that twenty years later.

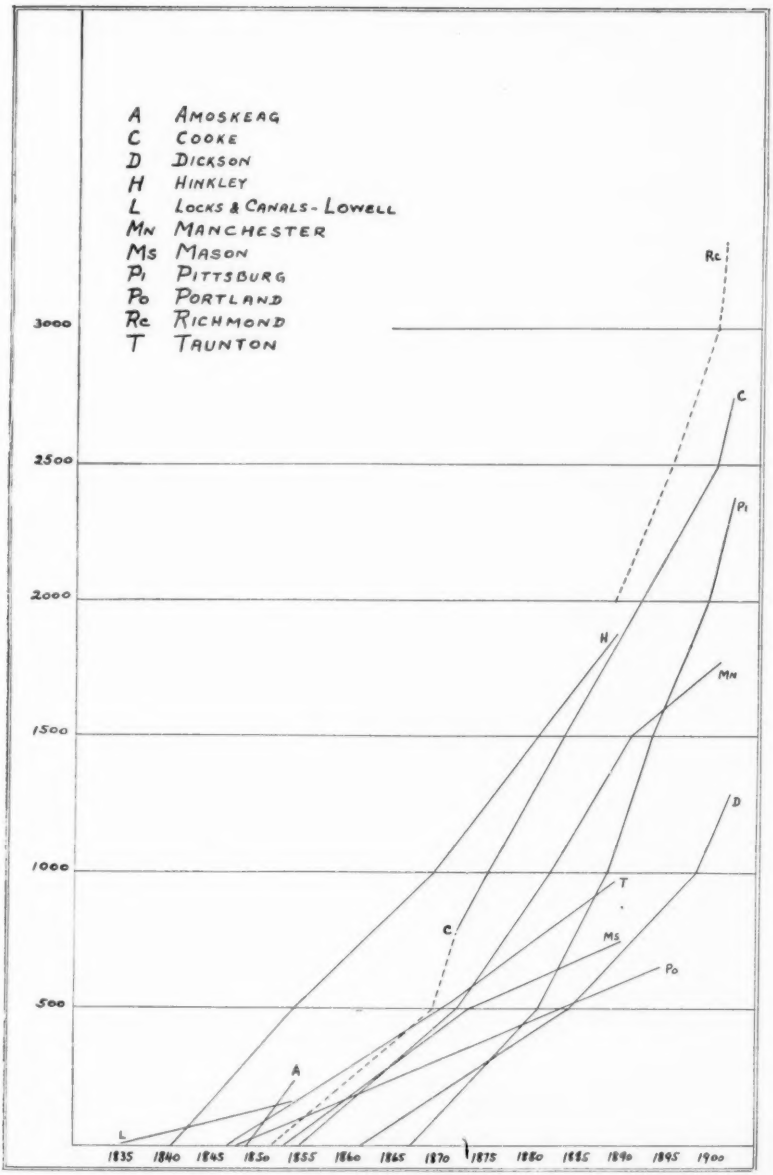
Turning to the state of Maine, the Portland Locomotive Works were brought into being by the construction of the roads between Portland and Montreal. The line in the state of Maine had to have engines and a group of enterprising Portland men organized a company for that

purpose. They were active until the middle nineties, they built one engine in 1907, and then locomotive building ceased. In New Hampshire, the Amoskeag Manufacturing Co., a concern of several enterprises, undertook the construction of locomotives in 1849. In 1855 they sold their locomotive interests to a group of men who started the Manchester Locomotive Works. Although forced to discontinue during the Civil War, they resumed operations in 1866 and continued to build as a separate company until the formation of the American Locomotive Co. In Vermont, A. Latham & Co. at White River Jct., built engines for a couple of years until closed by the panic of 1857.

In Massachusetts, the first concern to build locomotives was the Mill Dam Foundry in 1834. One locomotive was built that year and another was built the year following and then locomotive building ceased. Over in South Boston, in 1848, Jabez Coney built two locomotives and then he quit. Theodore Lyman and John Souther, in partnership, took the Coney plant and built one engine and then the partners must have disagreed. At any rate, John Souther continued for several years, not only as a builder of locomotives but of steam shovels and later, sugar mill machinery. We also find him in partnership with J. R. Anderson of Richmond, Va. Just when this partnership was dissolved, we do not know. Souther returned north, upon the outbreak of hostilities with the south, the U. S. Navy purchased his buildings and land and although he continued building various types of machinery, his locomotive building ceased by 1864. Another builder in Boston was Seth Wilmarth. He commenced about the same year as John Souther, 1848 and continued until 1855. A disastrous contract for some locomotives with the Erie Ry. closed his activities. At the close of the Civil War, McKay & Aldus commenced building locomotives in East Boston in 1864. As in the case of Seth Wilmarth, a contract with the Central Pacific R. R. closed their activities in 1868. Nath'l. McKay was later identified with the McKay Iron & Locomotive Co. of Jersey City, N. J., in the old Breeze & Kneeland plant but he discontinued building in 1869. By far the most famous locomotive works in Boston was the one started by Holmes Hinkley in 1841. Under the names of Hinkley & Drury, Boston Locomotive Works, Hinkley & Williams and Hinkley Locomotive Works, locomotives were built until 1889 when the works were sold to make room for the generating plant of the West End Street Railway.

Across the Charles River in Cambridge two firms have built locomotives. The first, Davenport, Bridges & Kirk, builders of freight and passenger equipment, the Mr. Kirk associated in this partnership built locomotives in Cambridgeport from 1850-1852. Then, Campbell & Whittier, builders of the locomotives on the Mt. Washington Ry. built locomotives here in 1866.

To the north of Boston we find George Coney building locomotives at North Andover under the Ballardvale Mfg. Co. between 1848 and 1849. At Lawrence we find the Essex Co. building between 1850 and 1852. One of the most ambitious concerns was the Lawrence Machine Co. They appear to be an outgrowth of the Essex Co. but it was the



Locomotive Production.

intention of J. C. Hoadley and his associates to build not only locomotives but car wheels, tires, machine tools, cannon—a plant in fact that would rival the Krupps of Germany. The panic of 1857 definitely closed these ambitious plans. One of the most interesting pioneers to the north of Boston was the Locks & Canals Co. of Lowell, later the Lowell Machine Shops. Originally a canal company, the water power was used for the manufacture of textile machinery. In 1835 they commenced building locomotives and they continued to build until 1854, save for an order of five 4-6-0 engines furnished the Baltimore & Ohio R. R. in 1864-65. Perhaps the graduates of these shops—Walter McQueen, Zerah Colburn, Wilson Eddy and Oliver Cushing were more famous than their products.

In the central part of the state, Springfield, locomotives were built under the names of the Springfield Car & Engine Co., Blanchard & Kimball and Bemis & Co., from 1848 to 1857. The works were subsequently used by the Wason Co., builders of passenger equipment.

At Taunton, the Taunton Locomotive Works commenced building locomotives in 1847 and continued building until 1890. William Mason, a successful builder of cotton machinery, commenced building in 1853. A few years after his death the company gave up building locomotives and devoted their energies to cotton machinery. From 1854-1857 locomotives were built by the Matfield Mfg. Co. at East Bridgewater.

In the next state, at Providence, Rhode Island, Corliss Nightingale, builder of stationary engines built six engines in 1851. One of these engines had the Corliss valve gear, subsequently removed, and this closed the locomotive building career of a very capable builder of stationary engines. At the close of the Civil War, Gen. Burnside and a group of associates formed the Rhode Island Locomotive Works. They built a particularly sturdy and handsome engine and they soon won nationwide attention. When the American Locomotive Co. was formed, the Rhode Island works was one to form the consolidation.

Over in the Empire State, the first concern to build locomotives in America—the West Point Foundry, ranks as a pioneer. They were already building stationary engines when the "Stourbridge Lion" and her sisters for the Delaware & Hudson were landed on the wharf for their trip up the Hudson. With their foundry at Cold Spring they were in a position to engage in this work but after five years gave up locomotive building. In New York City we find other builders—H. R. Dunham & Co., 1836-1838, Browning, Dunham & Co. 1837, Dunbar & Co. 1836 and W. T. James of about the same period. All built a few engines and then gave up the struggle.

Right above Cold Spring was the Matteawan Machine Co. at Fishkill Landing whose activities extended from 1849-1850; and the Poughkeepsie Locomotive Works at that point with their single locomotive of 1838. At Albany we find Walter McQueen in this work in 1840. Subsequently he moved to Schenectady and became the Superintendent of the Schenectady Locomotive Works. This concern commenced building locomotives in 1851 and today it is the main works of the American

Locomotive Co. It was a notably successful enterprise and in later years they developed a type extremely simple to build, capable of being built in large numbers thus meeting the keen competition of the times. Schenectady engines found great favor, as the records show. In their prosperous days, Norris of Philadelphia had a works here, turning out locomotives from 1846-1851.

A few miles west, at Rome, was an establishment known as the New York Locomotive Works, though their steam chest castings bore the simple word—Rome. This concern commenced building in the early eighties and quit, due to the keen competition, in the middle nineties. At Auburn we find the firm of Dennis, Wood & Thomas. The works adjoined the State Prison and they probably did work for that institution. They appear to have built at least one engine and furnished parts of others between 1840 and 1842. At Buffalo, we find the Buffalo Steam Engine Works active during 1855 and at Dunkirk, we find the popular builder, Horatio G. Brooks commencing his activities in 1869. At first his locomotives were closely patterned after the Rogers but he soon designed an exceedingly simple, but handsome engine, known for its performance and reliability. The works today are a part of the American Locomotive Co.

Nearness to New York harbor and the iron mines of northern New Jersey probably had much to do with the many establishments in that state. In Jersey City, Breese & Kneeland, New York Locomotive Works, commenced building locomotives in 1854. Three years later Wm. G. Hamilton of the Ramapo Iron Works was admitted to the firm and the name changed to Jersey City Locomotive Works. In the sixties, James McHenry, promoter of the Atlantic & Great Western Ry. purchased control and its products went to that road. After the close of the Civil War the works were idle and Nath'l. McKay of McKay & Aldus of Boston tried building from 1868-1869 and then he, too, gave up building. At Newark, we find that ingenious Seth Boyden built locomotives in 1837.

Paterson has been the home of many locomotive builders, chief of which was the famous Rogers Works. Starting under the partnership of Rogers, Ketchum & Grosvenor in 1837, the firm continued as such until the death of Thomas Rogers in 1856 when it was reorganized as the Rogers Locomotive & Machine Co. In 1893 the name was shortened to the Rogers Locomotive Co., later Works and in 1905 they became a part of the American Locomotive Co. The records indicate that Rogers furnished many of the engines to our southern roads. The Civil War led the company to seek new markets and when peace came the Rogers engines again went south. As one man has so aptly said—"Roger built a good engine!"

The firm of Swinburne, Smith & Co. commenced building locomotives at Paterson in 1848. In 1851 William Swinburne started under his own name but was forced out by the panic of 1857. The former company was incorporated as the New Jersey Locomotive Works and they continued until a New York broker, D. B. Grant secured control in 1863 and for twenty years the firm continued as the Grant Locomotive Works and then they suspended building.

In 1852, Danforth, Cooke & Co., builders of cotton machinery commenced to build locomotives. In 1865 the firm was reorganized as the Danforth Locomotive & Machine Co., and, upon the death of Mr. Cooke in 1882, became known as the Cooke Locomotive & Machine Co. In 1901 it became a part of the American Locomotive Co.

One other builder found frequently listed in the rosters is John Brandt. The latter was superintendent of the New Jersey Locomotive Works—I mention him because many regard him as building under his own name.

In Trenton, under the leadership of Isaac Dripps, we find the firm of Van Cleve, McKean, Dripps & Co., later known as the Trenton Locomotive Works, commencing to build locomotives in 1853. The panic of 1857 ended their locomotive activities but during the Civil War the works turned out a great deal of ordnance.

It is only natural that the state of Pennsylvania with its great mineral wealth and its skilled mechanics should engage in this industry. The oldest of all of our locomotive builders today is the Baldwin Locomotive Works of Philadelphia. A miniature locomotive was completed by M. W. Baldwin in 1831 and "Old Ironsides" was completed the year following. Although Mr. Baldwin vowed he would never build another locomotive it was only his death in 1866 that caused him to cease his labors. The firm carried on and still carries on today, building locomotives for this country and for export as well. Scarcely a continent today but has not heard the Baldwin bell.

Close on the heels of M. W. Baldwin came the partnership of Col. Stephen H. Long and William Norris in 1832. In 1834 the duties of Col. Long caused him to withdraw from the partnership and William Norris continued under his own name. In 1846 Septimus Norris was admitted as a partner and the name changed to Norris Brothers. In 1852 or 1853, H. Latimer Norris became a partner and the badge plates were inscribed—Richard Norris & Son and continued as such when the last locomotives were built either in 1864 or 1865. The old shops in Philadelphia were purchased by the Baldwin Works. In either 1865 or 1866, the old Lancaster Locomotive Works at Lancaster were taken by the Norris interests and locomotives were built until 1867. Mention has already been made of their venture at Schenectady, N. Y. The Norris Works built a large number of engines and held a high position in the locomotive building field. It was unfortunate they could not continue.

Other builders of locomotives in Philadelphia were James Brooks, formerly associated with Long & Norris who built locomotives in 1840. Stacy Costell, a watchmaker, in 1831 organized the Pennsylvania Locomotive Works, built one, possibly two engines and then quit. Garrett & Eastwick of Philadelphia, built locomotives from 1835-1838 and the firm of Eastwick & Harrison continued until 1842 when an offer from the Czar of Russia to build the motive power and rolling stock for the St. Petersburg-Moscow line caused the partners to close their doors and

move to Russia. One other firm in Philadelphia, Coleman Sellers & Son built locomotives from 1836-1841 in connection with their foundry and machine work.

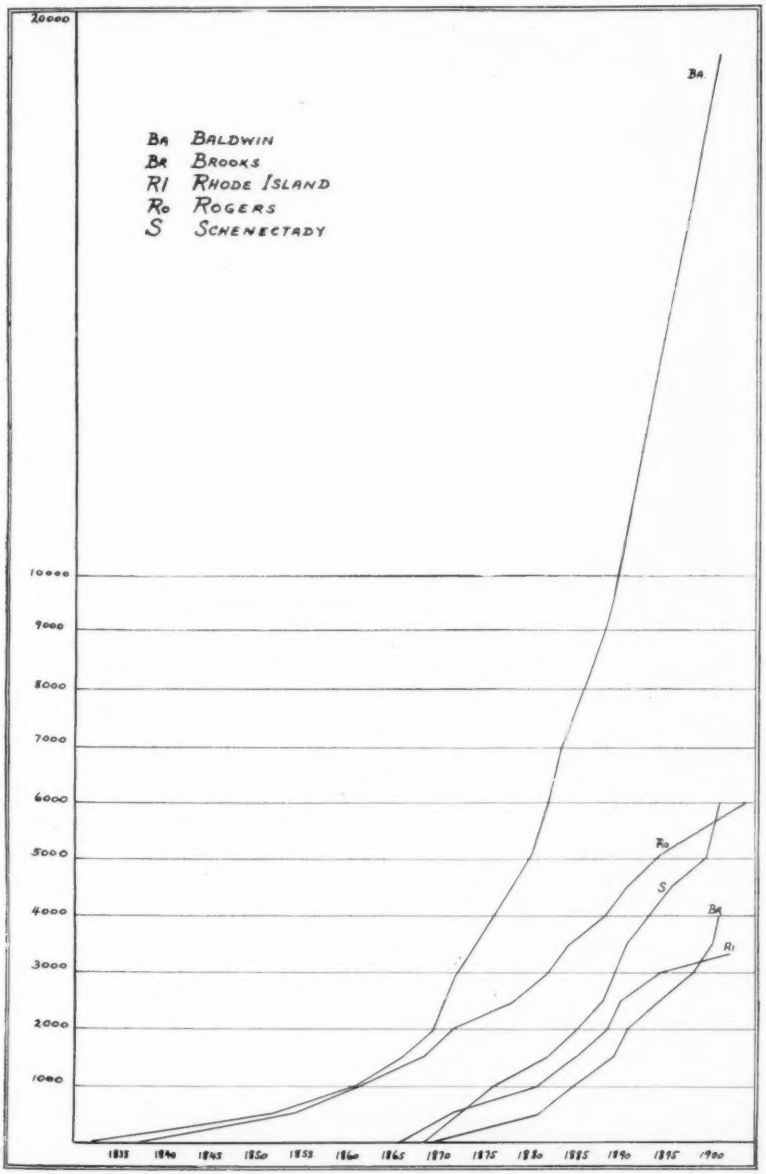
At Lancaster, James Black started the Lancaster Locomotive Works in 1853. In 1854, John Brandt of the New Jersey L. W. was engaged as Superintendent and the firm continued to build locomotives until the outbreak of the Civil War. The locomotives built at Lancaster were also known as Brandt engines. At York, we find Phineas Davis commencing to build locomotives in 1831. His first engine, the well known "York" was delivered to the Baltimore & Ohio R. R. Two more locomotives were built under the partnership of Davis & Gartner but this was dissolved by the employment of Davis by the Baltimore & Ohio R. R.

In the western part of the state, at Pittsburgh, we find the firm of McClurg, Wade & Co., commencing to build locomotives in 1834. The building of the Allegheny Portage R. R. stimulated their efforts but their activities ceased in 1837. David Bell commenced building locomotives under his name in 1866, then under the partnership of Porter, Bell & Co., and finally under the H. K. Porter Co. who are still active today. A year later saw the start of the Pittsburgh Locomotive & Car Works. With the dropping of building cars, the firm continued to build locomotives and became a part of the American Locomotive Co.

At Connellsville we find Dawson & Bailey building locomotives there in the very early eighties and later a firm known as the National Locomotive Works from 1890-1895. At Scranton, an enterprise building mining machinery decided to build locomotives and the Dickson Locomotive Manufacturing Co. commenced building locomotives in 1862 and subsequently became a part of the American Locomotive Co. At Reading, we find D. H. Dotterer & Co. building locomotives from 1839-1842 and Lewis Kirk, after leaving the Philadelphia & Reading R. R. built at least one engine. And lastly, the Vulcan Iron Works of Wilkes-Barre, a firm established in 1848, has built and continues to build light locomotives.

Delaware has seen only one locomotive building establishment, New Castle Manufacturing Co., at New Castle. Starting out in 1832, Mr. E. A. G. Young continued to build locomotives under his own name until 1839 when the New Castle Manufacturing Co. was formed in 1840 and we have a record of locomotive construction until 1858.

It was only natural that Baltimore, home of the Baltimore & Ohio R. R. should witness several firms building locomotives. The shops of this road were rented to men who contracted to keep the locomotives in repair. The first of these was Phineas Davis and it seems possible that Charles Reeder completed certain of his engines letting the credit go to Davis. Next came Gillingham & Winans and then, about 1843, Ross Winans erected what was then the largest locomotive building establishment opposite the Mount Clare Shops. Winans built not only for the B. & O. but for other roads and he continued to build actively until 1860. Other firms of Baltimore who have built locomotives are Denmead & Son, 1853-1859; Murray & Hazelhurst, 1854-1857, Hayward, Bartlett



Locomotive Production.

& Co., under the name of the Baltimore Locomotive Works in 1863-1867. One other company, the Mt. Savage Locomotive Works, built chiefly narrow gauge engines from 1875-1885 at Mt. Savage, Md.

Continuing southwards, we are not surprised to find that Virginia has been almost as prolific in builders as some of our northern states. Not far from Washington, at Alexandria we find credit given to T. W. Smith of building three locomotives in 1837. We then find the firm of R. C. & T. Smith building locomotives in 1851 and then the firm of Smith & Perkins building from 1851-1857. In 1856 we find locomotives constructed by the Virginia Locomotive & Car Works, the new name for Smith & Perkins and it would seem as though the panic of 1857 closed their doors.

At Richmond, we find D. I. Burr building locomotives from 1837-1841; Messrs. Burr, Pea & Sampson in 1846 and Burr & Ettinger in 1852. Another firm to build locomotives was that of Talbott & Bros., 1849-1852. Of these former builders, probably the most famous was J. R. Anderson. We find locomotives credited to his construction from 1852-1854, but we know that Anderson, Delaney & Co., proprietors of the Tredegar Engine Works built engines from 1852-1858. We also know that John Souther of Boston formed a partnership with Anderson and we find locomotives constructed under that partnership from 1853-4. We must remember however, it was not impossible for one man to have separate partners in separate enterprises. At any rate the activities of J. R. Anderson leave much to be desired. Locomotive building activities seemed to have ceased in 1858 but we know these shops did valiant work for the Confederacy. It was not until 1886 that the Richmond Locomotive Works commenced to build locomotives. Already builders of stationary engines, they entered the locomotive building field and these works became a part of the American Locomotive Co.

Two other builders deserve mention in this state—Uriah Wells at Petersburg who built locomotives from 1851-1857 and the Appomattox Locomotive Works of the same place, possibly under the direction of Uriah Wells, credited as building locomotives in 1856.

Charleston, S. C., home of the South Carolina Canal & R. R. Co. has seen some locomotive building though how much was in the shops of that road and how much outside, we don't know but it should form a fertile field for research. Rosters credit Easton & Dotterer as building locomotives between 1833 and 1838 and Thomas Dotterer in 1837. E. L. Miller built locomotives between 1833-4 and the firm of McLeish & Smith in 1837, while J. McLeish is credited as building locomotives in 1851.

In Georgia, we find J. J. McDonough of the Savannah Machine Co., buying discarded locomotives, thoroughly renovating them and then offering them for sale. His activities were chiefly with the southern roads after the Civil War. Another firm in the south was the Nashville Manufacturing Co., of Nashville, Tennessee, builders of locomotives from 1852-1853.

In Kentucky we find Cowles, Sickles & Co., oftener referred to as the Covington Locomotive Works, building locomotives in 1854. Olm-

stead, Tenneys & Peck—Kentucky Locomotive Works at Louisville, built engines prior to 1855 and the Louisville Locomotive Works were building locomotives in 1871.

Of our mid-western states, Ohio has been the most active along these lines. Across from Kentucky, at Cincinnati, several firms have built locomotives at one time or another. Here again is another field for research if only to form a continuity of the activities of A. Harkness. Rosters show his activities between 1846-1848; Harkness & Co., 1847-1849; A. Harkness & Son, 1848-1852; A. Harkness & Sons, 1851-1854 and Harkness, Moore & Co. 1852-1853. We find Moore & Richardson building locomotives from 1853-1861; Niles & Co. 1852-1859 and the Cincinnati Locomotive Works between 1854 and 1857. At Dayton we find the firm of E. Thrasher & Co. of about this period. Farther north we find the Galion Locomotive Works building engines at that point in 1856 and C. Cooper & Co. or Cooper, Clark & Co., building engines at Mt. Vernon in 1854. Messrs. H. & F. Blandy of Zanesville, owners of a machine shop engaged in locomotive building from 1852-1858 and then gave up.

Of the older builders, the most famous in this state was the Cuyahoga Locomotive Works at Cleveland, Ohio. They built a smart engine, furnished them to many of the roads in their section and the prospects were bright until dimmed by the panic of 1857. They built from 1850-1858. One of the three large firms building locomotives at the present is located at Lima. Originally builders of the Shay geared locomotive, commencing construction in 1879, at the turn of this century they entered the construction of regular locomotives, such as we are discussing, and their activities have continued to date.

Of the other mid-western states, C. A. Olmstead & Co., Aurora Locomotive Works was building locomotives at Aurora, Indiana in 1856. H. H. Scoville, Chicago Locomotive Works, built locomotives from 1853-1856. De Graff & Kendrick, Detroit Locomotive Works, built from 1854-1867; the Menominee Locomotive Works at Milwaukee, Wis., built from 1852-1857 and Palm, Robertson & Co., of St. Louis, Mo., built from 1853-1858. Lastly, the Davenport Locomotive Works at Davenport, Iowa, commenced the construction of light locomotives in 1897 and still continues.

On the Pacific Coast only two builders are listed in the rosters—H. J. Booth & Co., of San Francisco who built from 1861-1868 and the Vulcan Iron Works of San Francisco who built in 1862.

The American Locomotive Co. was a consolidation of several of the builders in 1901. The increasing size of locomotives calling for heavier and more powerful machinery has caused this company to place such equipment in one plant—at Schenectady. Typical of this was the old Manchester Works with its narrow head room in the erecting shop. Of sufficient height to take care of the locomotives of the nineties, considerable trouble was found in building the last order of engines for the Boston & Maine. Although switching engines were built there for a time, still these outgrew the facilities and the plant was closed about 1913.

The Rhode Island Works continued but with the advent of the automobile, the company decided to enter that field and for a time the ALCo. car and truck was built here. The company soon gave up that work and the last work done here was war work in the first World War. The Rogers Works, not having any railroad siding, the locomotives had to be drawn by horses through the streets of Paterson for shipment. The Dickson Works were sold to the D. L. & W. and they now form the repair shops for that road at Scranton. In 1902 the Locomotive & Machine Co. of Montreal, Ltd., was formed and in 1904 they commenced building engines for the Canadian railroads. At the close of the last World War, only the plants at Schenectady, Dunkirk, Pittsburgh, Richmond and Cooke were in operation. The majority of these are closed now. The activities are practically carried on at Schenectady and certain work has been done in the Dunkirk and Richmond plants and these with the Montreal Works form the active parts of the American Locomotive Co. today.

No mention has been made in this paper of the hundreds of locomotives built in the repair shops of the different railroad companies. At one time and another nearly all of our larger roads have built locomotives by their Mechanical Department. This may have been done because the road felt that they could build a better engine and at a lower price than the builder or in some instances it was done to stabilize labor. Here during the slack periods the men not needed for repairs were used to construct new locomotives, a feature that even today might be used in order to prevent a high labor turnover. With the coming of larger locomotives and the facilities needed for their construction and not needed for repairs, the majority of the railroads ceased locomotive construction. Outstanding examples of recent years are the Pennsylvania R. R. with its facilities at Altoona; the Southern Pacific with its Sacramento Shops, the Norfolk & Western R. R. at Roanoke, Va., the Louisville & Nashville with its South Louisville Shops, and both of our roads to the north, the Canadian National and Canadian Pacific have continued to build in their own shops.

Neither has any mention been made of the two locomotives built by the U. S. Military R. R. during the Civil War, nor that Civil War speculator, L. B. Tyng, who had rebuilt for him at least one engine in the repair shops of a railroad with the hopes of selling it to the U. S. Government. George A. Haggerty of Southbridge, Mass., and his home made "Putnam" and doubtless there were others that deserve mention in closing this list of builders.

Through the kindness of Robert R. Brown, I am presenting two charts that graphically show the construction of fifteen companies whose records have been copied and now are on file with this Society. A word of explanation is needed relative to the Cooke and Richmond records. The former commenced building in 1852 but the destruction of these early records leaves us with accurate knowledge until January, 1872 when construction #785 starts those that we have today. It would appear as though the series was unbroken and the old one continued in

1865. The Richmond people first started building stationary engines and upon the building of locomotives assigned their numbers indiscriminately to stationary engines and locomotives alike. The first locomotive, completed in 1887 bears construction #1612 and this accounts for the high numbers for the thousand odd engines built by this firm.

In the second table I have indicated the construction number of the first engine built by these builders on or after January 1st of the years indicated and in the list of builders I have listed approximately, save in those marked with an (*), the years of their locomotive building activities. These are based on a survey of nearly one thousand locomotive rosters. I daresay there are probably errors of a few years either at the beginning or the close of their activities. That possibly some, listed as builders, in reality were heads of the Mechanical Department of the road on which their name appears. In some instances two or more roads appear as having their engines and for that reason they are included. It is my hope, however, that this article and these tables and charts will serve to give our readers an idea of the activities of the builders of the "Iron Horse" and possibly to stimulate research in certain fields where information is lacking. No one builder or group of builders can state that they are responsible for the success of the steam locomotive. Its success has been due to hundreds of men, whether on the drawing board, in the shop or on the drop pit of the roundhouse, each one contributing his bit to the success of the steam locomotive.

LOCOMOTIVE BUILDING IN THE UNITED STATES WITH LOCATION AND APPROXIMATE PERIOD OF CONSTRUCTION

(*) Dates from Corporate Records.

American Locomotive Co. Main plant at Schnectady, N. Y. A consolidation of Brooks Locomotive Works Cooke Locomotive & Machine Co. Dickson Manufacturing Co. Manchester Locomotive Works Pittsburgh Locomotive & Car Works Rhode Island Locomotive Works Richmond Locomotive Works Schenectady Locomotive Works Rogers Locomotive Works (acquired in 1905)	New York, N. Y.	1901-date
Amoskeag Mfg. Co.	Manchester, N. H.	1849-1855*
J. R. Anderson & Co.	Richmond, Va.	1852-1854
Anderson & Delany	Richmond, Va.	1855-1858
Anderson & Souther	Richmond, Va.	1853-1854
Tredegar Works	Richmond, Va.	1850-1858
Appomattox Loco. Works	Petersburg, Va.	1856-
Aurora Loco. Works C. A. Olmstead & Co.	Aurora, Ind.	1856-

Baldwin Locomotive Works	Philadelphia, Pa.	1831-date
Built under the following names:		
Matthias W. Baldwin		1831-1839
Baldwin, Vail & Hufty		1839-1841
Baldwin & Vail		1841-
Baldwin & Whitney		1842-1846
M. W. Baldwin		1846-1854
M. W. Baldwin & Co.		1854-1867
M. Baird & Co.		1867-1873
Burnham, Parry, Williams & Co.		1873-1891
Burnham, Williams & Co.		1891-1909
Baldwin Locomotive Works		1909-1911
The Baldwin Locomotive Works		1911-date
Ballardvale Mfg. Co.	North Andover, Mass.	1848-1849
Baltimore Loco. Works	Baltimore, Md.	1863-1867
Bemis & Co.	Springfield, Mass.	1857-
Blanchard & Kimball	Springfield, Mass.	1854-
H. & F. Blandy	Zanesville, Ohio	1852-1858
Seth Boyden	Newark, N. J.	1837-
H. J. Booth & Co.	San Francisco, Cal.	1861-1868
James Brooks	Philadelphia, Pa.	1840-
Brooks Loco. Works	Dunkirk, N. Y.	1869-1901*
Buffalo Steam Engine Works	Buffalo, N. Y.	1855-
Burr & Ettinger	Richmond, Va.	1852-
Burr, Pea & Sampson	Richmond, Va.	1846-
David I. Burr & Co.	Richmond, Va.	1837-1841
Campbell, Whittier & Co.	Cambridgeport, Mass.	1866-
Chicago Loco. Works	Chicago, Ill.	1853-1856
H. H. Scoville & Sons		
Cincinnati Loco. Works	Cincinnati, Ohio	1854-1857
Clark, Cooper & Co.	Mt. Vernon, Ohio	1854-
Cooke Loco. & Machine Co.	Paterson, N. J.	1852-1901*
Danforth Loco. & Machine Co.	Paterson, N. J.	1865-1882
Danforth, Cooke & Co.	Paterson, N. J.	1852-1865
Jabez Coney	South Boston, Mass.	1848-
Corliss, Nightingale & Co.	Providence, R. I.	1851-
Stacey Costell	Philadelphia, Pa.	1831-
Covington Loco. Works	Covington, Ky.	1854-
A. L. Greer & Co.		
Cuyahoga Steam Furnace Co.	Cleveland, Ohio	1850-1856
Davis & Gartner	York, Pa.	1832-
Phineas Davis	York, Pa.	1831-
Davenport Loco. Works	Davenport, Iowa	1897-date
Dawson & Bailey	Connellsville, Pa.	1879-1882
Denmead & Son	Baltimore, Md.	1853-1859
Dennis, Wood & Thomas	Auburn, N. Y.	1840-1842
Detroit Loco. Works	Detroit, Mich.	1854-1857
De Graff & Kendrick		
Dickson Manufacturing Co.	Scranton, Pa.	1856-1901*
D. H. Dotterer & Co.	Reading, Pa.	1839-1842
H. R. Dunham & Co.	New York, N. Y.	1836-1838
Browning, Dunham & Co.	New York, N. Y.	1837-
Eason & Dotterer	Charleston, S. C.	1833-1838
Thomas Dotterer	Charleston, S. C.	1837-
Essex Co.	Lawrence, Mass.	1850-1852
Eastwick & Harrison	Philadelphia, Pa.	1839-1842
Garrett & Eastwick	Philadelphia, Pa.	1836-1838
Galion Loco. Works	Galion, Ohio	1856-
Grant Loco. Works	Paterson, N. J.	1848-1883
New Jersey Loco. Works	Paterson, N. J.	1851-1863
Swinburne, Smith & Co.	Paterson, N. J.	1848-1851
Smith & Jackson	Paterson, N. J.	?

Harkness, Moore & Co.	Cincinnati, Ohio	1852-1853
Harkness & Sons	Cincinnati, Ohio	1851-1854
Harkness & Co.	Cincinnati, Ohio	1847-1849
A. Harkness & Son	Cincinnati, Ohio	1848-1852
A. Harkness	Cincinnati, Ohio	1846-1848
Hayward & Bartlett	Baltimore, Md.	1863-1867
Hinkley Loco. Works	Boston, Mass.	1841-1889
Hinkley & Williams	Boston, Mass.	1864-1870
Hinkley, Child, Ayer & Williams	Boston, Mass.	1861-1864
Boston Loco. Works	Boston, Mass.	1848-1861
Hinkley & Drury	Boston, Mass.	1831-1848
W. T. James	New York, N. Y.	1840-(?)
Jersey City Loco. Works	Jersey City, N. J.	1854-1866
Breese & Kneeland	Jersey City, N. J.	1854-1857
Kentucky Loco. Works	Louisville, Ky.	1856-
Olmstead, Tenneys & Peck		
Lewis Kirk	Cambridgeport, Mass.	1850-1852
Lewis Kirk	Reading, Pa.	Prior to 1858
Lancaster Loco. Works	Lancaster, Pa.	1853-1861
A. Latham & Co.	White River Jct., Vt.	1854-1856
Lawrence Machine Shops	Lawrence, Mass.	1852-1857
Lima Locomotive Works	Lima, Ohio	1879-date
Louisville Loco. Works	Louisville, Ky.	1871-
Lowell Machine Shops	Lowell, Mass.	1845-1854
Locks & Canals Co.	Lowell, Mass.	1835-1845
McClurg, Wade & Co.	Pittsburgh, Pa.	1834-1837
McKay & Aldus	East Boston, Mass.	1864-1868
McKay Iron & Locomotive Co.	Jersey City, N. J.	1869-
McLeish & Smith	Charleston, S. C.	1837-
J. McLeish	Charleston, S. C.	1851-
Walter McQueen	Albany, N. Y.	1840-
Manchester Loco. Works	Manchester, N. H.	1855-1901*
Mason Machine Works	Taunton, Mass.	1853-1890*
William Mason	Taunton, Mass.	1853-1883
Matfield Mfg. Co.	E. Bridgewater, Mass.	1854-1857
Matteawan Machine Co.	Fishkill Landing, N. Y.	1849-
Menominee Loco. Wks.	Milwaukee, Wis.	1852-1857
Mill Dam Foundry	Boston, Mass.	1834-1835
E. L. Miller	Charleston, S. C.	1833-1834
Moore & Richardson	Cincinnati, Ohio	1853-1861
Mount Savage Loco. Works	Mt. Savage, Md.	1875-1885
Murray & Hazelhurst	Baltimore, Md.	1854-1857
Nashville Mfg. Co.	Nashville, Tenn.	1852-1853
National Loco. Works	Connellsville, Pa.	1890-1895
New Castle Mfg. Co.	New Castle, Del.	1832-1858
E. A. G. Young	New Castle, Del.	1832-1839
New York Loco. Works	Rome, N. Y.	1880-1895
Niles & Co.	Cincinnati, Ohio	1852-1859
Richard Norris & Son	Philadelphia, Pa.	1832-1865
Norris Bros.	Philadelphia, Pa.	1846-1852
William Norris	Philadelphia, Pa.	1834-1846
Long & Norris	Philadelphia, Pa.	1832-1834
Norris	Schenectady, N. Y.	1846-1851
E. S. Norris	Lancaster, Pa.	1864-1867
Palm & Robertson	St. Louis, Mo.	1853-1858
Pittsburgh Loco. & Car Works	Pittsburgh, Pa.	1867-1901*
H. K. Porter Co.	Pittsburgh, Pa.	1866-date
Porter, Bell & Co.	Pittsburgh, Pa.	
David Bell Co.	Pittsburgh, Pa.	1866-1871
Portland Loco. Works	Portland, Maine	1848-1907*
Poughkeepsie Loco. Works	Poughkeepsie, N. Y.	1838-

Rhode Island Loco. Works	Providence, R. I.	1866-1901*
Richmond Loco. Works	Richmond, Va.	1886-1901*
Rogers Loco. Works	Paterson, N. J.	1837-1905*
Rogers Loco. & Machine Co.	Paterson, N. J.	1856-1893
Rogers, Ketchum & Grosvenor	Paterson, N. J.	1837-1856
Schenectady Loco. Works	Schenectady, N. Y.	1851-1901*
Coleman Sellers & Son	Philadelphia, Pa.	1836-1841
Smith & Perkins	Alexandria, Va.	1851-1857
Virginia Loco. & Car Works		
R. C. & T. Smith	Alexandria, Va.	1851-
T. W. Smith	Alexandria, Va.	1837-
John Souther	South Boston, Mass.	1848-1864
Globe Loco. Works		
Springfield Car & Engine Co.	Springfield, Mass.	1848-1851
William Swinburne	Paterson, N. J.	1848-1857
Swinburne, Smith & Co.	Paterson, N. J.	1848-1851
Talbott & Bros.	Richmond, Va.	1849-1852
Taunton Loco. Works	Taunton, Mass.	1847-1890*
E. Thrasher & Co.	Dayton, Ohio	1855-
Trenton Loco. Works	Trenton, N. J.	1853-1857
Vulcan Iron Works	Wilkes-Barre, Pa.	1848-date
Vulcan Iron Works	San Francisco, Cal.	1862-
Uriah Wells	Petersburg, Va.	1851-1857
West Point Foundry	New York, N. Y.	1830-1835
Seth Wilmarth	South Boston, Mass.	1848-1855
Ross Winans	Baltimore, Md.	1837-1860
Gillingham & Winans	Baltimore, Md.	1837-1843

LOCOMOTIVE BUILDERS CONSTRUCTION NUMBERS

	1840	1845	1850	1855	1860	1865	1870	1875	1880	1885	1890	1895	1900	1902
5- 1849 Amoskeag			4	186	231a									
1-12-1833 Baldwin	141	215	375	631	906	1330	2049	3724	4861	7481	10490	14151	17256	19848
12- 1-1869 Brooks							3	228	389	1059	1601	2502	3403	4114
1852 Cook				?	?	?	?	1004	1140	1612	1989	2315	2499	2755
3-31-1862 Dickson						7	48	156	234	520	731	925	1072	1387
7-27-1841 Hinkley		31	257	553	?	734	1024	1226	?	?	1807c			
1835 Locks & Canals—LMS	54	81	87	145c										
3-24-1855 Manchester					46	60	181	696	793	1216	1445	1628	1720	1793
10-11-1853 Mason				13	93	188	340	547	617	715	754			
4- 8-1867 Pittsburgh							64	318	396	753	1098	1539	2035	2418
7- 1848 Portland			14	74	104	115	169	317	358	534	602	627	628d	
9-27-1866 Rhode Island							163	676	817	1494	2264	2980	3150	3366
10-14-1837 Rogers	20	63	200	556	891	1226	1680	2391	2565	3535	4236	5028	5482	6272e
10- 1851 Schenectady				104	212	362	607	967	1202	1947	3007	4257	5279	6209
5-25-1847 Taunton			45	186	271	344	485	651	722	915	982			

a—Last engine built in 1858.
b—Last engine built in 1889.
c—Last engine built in 1854.
d—P. L. W. #628 was built in 1907.
e—Last engine built in 1905.

The last construction number of each builder will be found in the proper column.

Fall Brook Railway Locomotives

By Chas. E. Fisher

Subsequent to the publication of my roster of locomotives of this road in our Bulletin No. 55, additional data has been uncovered that warrants a revision of some of the locomotives that appeared in that bulletin.

Now it must be remembered that the first equipment was purchased by and jointly owned by the two companies—the Tioga Navigation Co. and the Tioga Coal, Iron, Mining & Manufacturing Co. The former became the Tioga Railroad Co. and the latter became the Corning & Blossburg R. R. and this road was the beginning of the Fall Brook Ry. By means of court papers and builders' lists we can construct with a fair degree of accuracy the locomotives purchased jointly by the Tioga Navigation Co. and the T. C. I. M. & M. Co. as follows:

Chemung	Albany Iron Works		1839			
Tioga	Baldwin	#131	1839			
Canisteo	Baldwin	#159	1840			
Conhocton	Baldwin	#150	1841	4-2-0	12x16"	54"
Chemung	New Castle		1841			
Tuscarora	Rogers K. & G.	# 29	1841	4-4-0	12x18"	48"
Susquehanna	Baldwin	#287	1847	0-6-0	13x18"	42"

These seven engines we have a record of being in service on these two roads. Whether the first "Chemung" developed a severe case of indisposition and was replaced by the second or whether there was an engine of this name on the north and south portions of the road, we will never know.

It was 1854 that John Magee purchased the Corning & Blossburg R. R., formerly the T. C. I. M. & M. Co. at the Sheriff's sale. Just how the equipment was divided we are not positive, but the court papers mention the locomotives "Chemung," "Tioga," "Canisteo," "Tuscarora" and "Conhocton" in the sale. We may assume that Magee purchased these locomotives. One thing that makes an accurate roster of these locomotives nearly impossible is due to the fact that the Magee interests absolutely controlled it. Necessary reports were made to the State of New York but printed stockholders reports for these early and even later years are rare.

By 1860 however, we know that the Fall Brook locomotives were numbered and we will list such changes as are necessary to complete and correct the roster that appeared in Bulletin #55:

1	"Fall Brook"	New Jersey L. & M. Co.	1860	4-4-0			
2	"Seymour"	New Jersey L. & M. Co.	1863	4-4-0			
3	"Deacon Lovejoy"	New Jersey L. & M. Co.	1864	4-4-0			
		Sold to Blossburg Coal, Mining & R. R. Co., in 1866					
3	"Tioga"	Schenectady	#1265	1880	4-4-0	18x24"	54"
4	"Benjamin"	This was the "Tioga" rebuilt and renamed.					
4	"Ulysses"	Schenectady	#4125	1893	4-4-0	18x24"	68"
5	"Jonathan"	This was the "Canisteo" rebuilt and renamed.					

5	"Columbus"	Schenectady	#4126	1893	4-4-0	18x24"	68"
6	"Paul"	This was a second hand engine built by Swinburne, purchased in 1869 and rebuilt in 1880					
7	"Lark"	Probably the "Conhocton" rebuilt and renamed.					
7	"Interstate"	Schenectady	#2238	1888	4-4-0	18x24"	57"
8	"Schuyler"	New Jersey L. & M. Co.		1863	2-6-0		
8	"Pritchard"	Schenectady	#4236	1894	4-4-0	19x24"	56"
9	"Seneca"	Schenectady	# 302	1863	4-4-0	16x24"	54"
9	Not Named	Schenectady	#4540	1897	4-4-0	20x24"	69"
10	"Chemung"	Schenectady	# 419	1866	4-4-0	17½x24"	64½"
10	"Presho"	Schenectady	#4237	1894	4-4-0	19x24"	69"
11	"Ward"	Grant		1866	4-4-0		
11	Not Named	Schenectady	#4541	1897	4-4-0	20x24"	69"
12-14	same as in Bulletin #55						
15	"Lawrence"	These three engines were purchased Jan. 28, 1876 from					
16	"Haskin"	the Morris Run Coal Mining Co. for $15,555. We have					
17	"Nearing"	nothing as to their identity. Nine years later they were replaced by the two engines listed in Bulletin #55					
18	"Beaver"	Brooks	# 226	1874	4-4-0	15x22"	62"
	Formerly McKean & Buffalo R. R. #1						
19-43	same as in Bulletin #55						
44	"Potter"	Baldwin reb NJRR&TCo.		1864	0-4-0	14x16"	60"
45	"Mulhollon"	Norris		1854	4-4-0	16x24"	54"
	Formerly P. R. R. Nos. 702 and 81, purchased from E. H. Wilson & Co.						
46-81	same as in Bulletin #55						

While I regret this additional data could not have been included in Bulletin #55, it is a satisfaction to be able to correct the original list for future reference.

Worth Reading

Compiled by

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BOOKS AND PAMPHLETS

Alphabetical List of Corporate Names of Carriers and Other Companies considered in connection with Valuation Work under Section 19A of the Interstate Commerce Act—Revised to January 1, 1942, by Accounting Section, Bureau of Valuation, Interstate Commerce Commission, Washington, D. C. [1], 127 mimeo. 1. Available on request to Accounting Division, as long as supply, limited by paper conservation requirements, lasts. "This book contains the names of all companies of record in the Accounting Section of the Bureau of Valuation. . ." p. [1]. A helpful aid in tracing railroad history, which has aroused the impish inquiry as to whether there were any railroads that did not get into the valuation records. Supplemented by *Alphabetical List of Corporate Names of Operating Carriers considered in connection with Valuation Work . . .—Revised to January 1, 1942,* by Accounting Section, also available on request as long as limited supply lasts.

Bonanza Railroads, by Gilbert H. Kneiss, xvi, 148 pp. Illustrations. End-paper maps showing locations of I. Sacramento Valley R. R.; II. San Francisco & San José R. R.; III. Virginia & Truckee R. R.; IV. Eureka & Palisade R. R.; V. Nevada Central R. R. Published by Stanford University Press, Stanford University, California. $3.00. "The Locomotives of the Bonanza Railroads," pp. 133-139. Respectfully urged on persons who have hitherto missed the Comstock Lode and early northern California in their historical reading.

Burlington West—A Colonization History of The Burlington Rail-Road, by Richard C. Overton. xviii, [2], 583 pp., including Maps, Illustrations. End-paper map: A Map showing the growth of the Burlington System 1850-1940. Cambridge, Mass., Harvard University Press. $4.50.

Commercial Air Transportation, by John H. Frederick. 493 pp. Tables, Maps, including end-paper maps: Air Express Map of the United States. Published by Richard D. Irwin, Inc., Chicago, Ill. $4.00. "Development of Air Transportation" pp. 135-156, reviews what some of us have been watching, whether we realized it or not. A lively supplement to this book can be Railway Age's tabulations in the article "Air Travel Statistics Come of Age" in the issue of April 11, 1942, pp. 756-757.

Commodore Vanderbilt—An Epic of the Steam Age, by Wheaton J. Lane. xiv, 357, xii pp. Illustrations. Maps. Published by Alfred A. Knopf, New York City as "The First Alfred A. Knopf Fellowship Award in Biography." $3.75.

A History of the Texas Railroads and of Transportation Conditions under Spain and Mexico and The Republic and The State, by S. G. Reed. x, 822 pp. Limited edition, published by subscription. ". . . In 1936 the one hundredth anniversary of the birth of the Republic of Texas was celebrated. In the same year that the Battle of San Jacinto was fought, the first charter for a railroad was granted by its first Congress to some of the heroes of that Battle. It is befitting that this be considered as the beginning of Texas railroad history and that this centenary be commemorated by a chronicle of this event. . . The author can speak from first hand knowledge of some of these events during the last half of this centenary as he was privileged to take part in them. When he began his railroad service in 1888 . . . Some of the railroad systems of today were not in existence then. The mileage was only half of what it is now . . ." p. vi.

Iron Horses—American Locomotives 1829-1900 by E. P. Alexander. 239 pp. Illustrations. Published by W. W. Norton & Co., Inc., New York City. $5.00. ". . . It should be emphasized that this volume by no means purports to be an exhaustive treatise on locomotives . . . Its purpose is rather to show a representative collection of types as locomotives evolved from the earliest primi-machines." Preface, p. 16.

Railway Research—A Review, March, 1942. cover-title, 36 pp. Published by Railway Age, 30 Church Street, New York City. 25 cents. Foreword, by J. G. Lyne, pp. 3-4, begins: "In presenting in pamphlet form this series of articles . . . there has been no attempt to be comprehensive. To aim at comprehensiveness would require a book, or indeed, several books . . ."

A Review of Railway Operations in 1941, by Julius H. Parmelee. 35 pp., including Tables. Published as Special Series Bulletin No. 71, April 1942, of Bureau of Railway Economics, Association of American Railroads, Washington, D. C. Available on request. Reprinted from Railway Age—Annual Statistical and Outlook Number, January 3, 1942, with figures revised.

South American Railway Congress—Its Origins, Aims and Activities, by International Permanent Commission, South American Railway Congress, Buenos Aires, Argentina. Cover-title, 11 pp. Available on request to the International Permanent Commission.

This Fascinating Railroad Business, by Robert Selph Henry, author of Trains. 520 pp. Illustrations and Diagrams. Indianapolis, Ind. and New York, Bobbs-Merrill Co. $3.50. How many railroads in the United States and elsewhere got where they are today, and some of the whys,

along with the language—in part—in American, Mexican, French Canadian, and English that has developed with them and keeps them running is told in this book. Chapter XXV—The Iron War Horse, pp. 413-431, outlines war use of railroads from the 1830s to 1942. Appendix: An "Anatomy of American Railroads" pp. 449-496.

ARTICLES IN PERIODICALS

Annual Speed Survey, by Donald M. Steffee. Railroad Magazine, January 1942, pp. 95-117. Illustrations and tables. ". . . The surge of accelerations to the mile-a-minute mark, and above that, has made our annual survey so lengthy as to require a whole magazine to itself. . ." p. 99.

Australia's Railways Built to Many Gages. Railway Age, April 11, 1942, pp. 754-755. *Map of Common Carrier Railroads in Australia (Mainland) Showing Diversity of Gages*, p. 755.

A Century of Railway Steamers, by Frank C. Bowen. Railway Gazette, January 2, 1942, pp. 8-12. Illustrated. "A brief review of the inauguration of railway ownership and the development of the distinctive cross-channel design."

The Military Railway Service, by Lewis T. Ross, Lieut. Col., Corps of Engineers; Chief, Railway Branch, Office, Chief of Engineers. The Military Engineer, February, 1942, pp. 71-75. Illustrated. Chart: *Organization of Military Railways and Inland Waterways, Theater of Operations*, p. 75. ". . . The geographical distribution of the units of the M. R. S. is not ideal, but the units must be thickest where there are the most railroads. . ." p. 74. ". . . It should be noted that the Manager, Military Railway Service, has no *construction* troops under his direct control. New construction is carried out by Army and Communications Zone general engineer troops. . ." p. 74. ". . . There are still many problems to solve. How shall we obtain facilities to train a major mobilization? Where will the young men with experience come from to make up the enlisted personnel—over 20,000 needed? Is our standard gauge light equipment the answer to forward operations rather than narrow gauge? These and many other questions must be answered. It appears obvious that in any major war, at home or abroad, the Military Railway Service will play an important part." p. 75.

The Need of an Indo-Burma Railway. Railway Gazette, March 6, 1942, pp. 330-331. *Sketch map of the transport links between India, Burma, and China*, shows railroads, the Burma Road, and the Assam Road, now under construction.

Peter Cooper—A Critical Bibliography of His Life and Works, by C. Sumner Spalding. New York Public Library Bulletin, September 1941, pp. 723-745. Part I—Works by Cooper, does not include his address at the 8th Annual Convention of the American Railway Master

Mechanics Association, May 12, 1875, in which he explained why he "got up a little locomotive." This address was reprinted in Railroad Gazette, July 3, 1875, pp. 273-274, and April 13, 1883, p. 225. Part II—Works about Cooper.

Railroad Women, by James W. Holden. Railroad Magazine, April 1942, pp. 74-87. "They number more than three per cent of the total rail employees; you find 'em in all kinds of jobs." Illustrated.

Research and Machines—Key to Track Maintenance in War, by A. E. Perlman. Railway Age, April 11, 1942, pp. 745-748. Illustrated. "Today, men and materials are being rigidly rationed. . . And daily as the war program gets under way, the load upon our transportation facilities increases. . . Difficult going has never made the American railroader slow his pace. During the depression years of the early 'thirties, he kept the railroads safe and efficient. He learned new ways of maintaining his properties which saved hundreds of millions of dollars for the railroads. And today—to help win the war—we must conserve man power and materials as never before. This can be done through the use of modern machinery and intensive research. For modern machinery can help us increase our production per man-hour, and research will permit us to lengthen the life of the materials we now use. It will aid us to find new designs which will reduce the amount of material necessary, or help us find new materials more adaptable to our use. . ." p. 745. On p. 748, after quoting Col. Ross's statement about "no *construction* troops" [see The Military Railway Service, in this list], Mr. Perlman, who is chief engineer, Denver & Rio Grande Western, commented: ". . . I concur fully in Colonel Ross' views, but would go even further in carrying out his aims. . ."

A Trans-African Railway—A Description of the Continuous Chain of 3 ft. 6 in. Gauge Lines, 2,926 Miles in Length from Lobito (in Portuguese Angola) on the Atlantic, to Beira on the Indian Ocean. Railway Gazette, February 27, 1942, pp. 303-308. Maps and Illustrations.

Transport Services and the War—Railway Gazette, London, England. A weekly feature since September 1939, which helps to keep up with railroad history in various parts of the world, as it goes along, these days. *No. 129* in issue of February 27, 1942, pp. 313-314, summarizes "Invasion Order for Railwaymen" by Railway Executive Committee. *No. 132* in issue of March 20, 1942, includes description of L. N. E. R. Rail-Mounted Trailer Pumps, "for maintaining water supply for locomotive sheds in the event of the main supply being interrupted by enemy action," which are shown in pictures, on p. 402, and "The Rail Link between Turkey and Bulgaria" recounting efforts to reopen a section destroyed in war operations, partly rebuilt—bridges and all—but not yet in operation because a sudden thaw in January carried away the Maritza Bridge.

Upper Canada Railway Society Bulletins, No. 1, October 1941—Mimeo. Issued by the Society in Toronto, Canada. "Canadian Railway History—Some Bibliographic Suggestions" in No. 4, January 1942, pp. 1-2.

New Books

"BURLINGTON WEST," by Richard C. Overton, 583 pages, 9¼x6, illustrated. Bound in cloth. Published by Harvard University Press, Cambridge, Mass. Price $4.50.

This is a story of the colonization work of a railroad, a great railroad, in the States of Iowa and Nebraska. The chief source of material is the records of the land grant papers of the railroad, now preserved in the Baker Library. The work has been carefully documented and indexed and it will be difficult for one to take or make exceptions to the statements made therein. It is the third book to cover the colonization activities of the railroads on this continent, the other two covering the Illinois Central and the Canadian Pacific.

Many of us today lose sight of the fact that our Great West could never have been settled without some form of transportation and here the railroad played its important role. Subsidies of some sort were necessary. Capital certainly would not invest in a road whose freight was to be the air in the box cars. These subsidies took the form of land, perhaps it was best they did, but it did prove an inducement of capital and it did settle and stimulate the growth of our great west.

There were scandals about some of these land grants but there have been scandals in industry also. We were a growing nation and we could not keep pace with our resources. Perhaps that is the reason why all acquired a bad name yet we honestly know we should differentiate each individual case. No doubt some of our pedagogues will classify this book as propaganda. That is a term that some use for documentary evidence or information presented counter to their narrow and old fashioned ideas. To these men, I strongly urge that they study, not read this book. I'll say more in that until they have studied this book they climb down from their rostrums and turn their thoughts to a careful analysis of the whole problem. Then they might return to their profession with a new viewpoint.

The Chicago, Burlington & Quincy R. R., recently celebrated its ninetieth birthday. In all that time the road has never been in the hands of the courts, thus proving the faith and integrity of its founders. The book deals with two of the subsidiary lines—the Burlington & Missouri River R. R. in Iowa and the road of the same name in Nebraska. Here we find Charles Russell Lowell, nephew of the poet and diplomat, at the age of twenty-three, laying the foundations of the Land Department that was to be followed to the end. Then comes that genius George S. Harris from the Hannibal & St. Joseph and it was his son, George B. Harris that presided over the destinies of the C. B. & Q. for many years. Throughout the entire period John Murray Forbes of Boston, James F. Joy of Detroit and Charles Elliott Perkins played important parts in the management of the corporation or of the land department. The road, today, stands as a monument to their integrity and judgment.

The records indicate that the amounts received from the lands granted in Iowa did not pay for by one half the actual construction of the railroad in that state. In Nebraska, the sale from lands more than covered the cost of construction from Plattsmouth to Kearney Junction. Many years have passed since Charles Russell Lowell wrote—"that he who would build a western railroad must also find a population and build up business." To that end did he and the other land commissioners direct their efforts—honestly and capably. If this book does nothing else than prove that the Burlington was an exception to the general misconception, it has served a good purpose and if we admit that there is one exception to this same general misconception, may there not be others?

"IRON HORSES," by E. P. Alexander, 237 pages, 11x8½, illustrated. Bound in cloth. Published by W. W. Norton & Co., Inc., New York, N. Y. Price $5.00.

In twenty-two pages of text the author briefly outlines the development of the steam locomotive. The balance of the book is devoted to excellent full page illustrations showing various types and products of present and former locomotive builders. The inside pages contain a reproduction of a page of locomotive builders found so often in our technical journals. A two page spread, in colors of the Pennsylvania R. R. "Tiger," built by Baldwin in 1856 and a roster of locomotive builders at the close are of added interest and value. Perhaps the greatest asset this book has is to serve as a medium of identifying the products of the different builders portrayed but it is regrettable that the vacant space found on each page of descriptive matter could not be more fully utilized. The author has done a good job and should be commended for his efforts.

"TRAINS IN TRANSITION," by Lucius Beebe, 210 pages, 11x8, illustrated. Bound in cloth. Published by D. Appleton-Century Co., New York, N. Y. Price $5.00.

This is the third picture book of trains and locomotives brought out by that noted columnist and train photographer. Like his previous books, this one is replete with views and "shots" in various positions, the majority by the author and many from his friends.

It may not be amiss to state some of the basic facts needed for a good railroad photographer. In addition to being a good photographer in every way that the term implies, he must do more. He should have a working knowledge of the road and its motive power on which the pictures are taken. The least he can do is to get from the nearest station a current timetable showing the arrangement of its passenger trains and make his notes accordingly. He should record carefully, the road number and wheel arrangement of the locomotive and the consist of the train. This is absolutely necessary if one is to place any reliance in his photographic work. There has been too much of this slap-dash guess work on the part of some amateurs and it is regrettable when it gets into print.

In the present volume there are certain mistakes and the author doubtless knows better. Just the same, they exist.

His caption under the B. & A. commuting train on page 124 is that the engine is of the 4-4-6 type. You might think so from the photograph but unless the B. & A. has changed them since yesterday they are of the 2-6-6 type for that particular group. Since when has a power reverse gear been known as a "Johnson Bar" or has the 2-8-0 been known as a rare type of engine? Does a locomotive become a "veteran" because it was built in 1927 and would authorities agree the first Diesel-electric passenger train was built in 1933?

Certain trains have certain well known consists of equipment that make them readily recognizable by those that know them. In his last book—"Highliners" are one or two that certainly do not seem to fit their captions. However, in this same book, the caption to the effect that the Canadian National "Mapleleaf" carries through coaches and Pullmans from Chicago-Toronto-Montreal to New York over the Canadian National, New York Central and New York, New Haven & Hartford Railroads is only equalled by the statement made on page 88 that the Boston & Albany "Wolverine" carries through equipment to Grand Rapids, Mich. Then, on page 71, the photograph taken by some one else, showing a B. & A. Berkshire type engine, at the head end of 120 cars, east bound, west of Pittsfield, Mass., certainly staggers the imagination. No doubt the B. & A. wishes they could!

Statements like these, and there are others, make the realist a skeptic to material of this kind. No one denies that Mr. Beebe ranks "ace high" as a photographer nor does one wish to deny him the use of such glowing language as he wishes to use. If a work of this kind is to have any value, the author should stick to the facts as they exist rather than to temperamental possibilities.

"Bonanza Railroads," by Gilbert H. Kneiss, 148 pages, 10x6¾, illustrated. Published by Stanford University Press, Stanford University, California. Price $3.00.

To the members of this Society, Gilbert Kneiss needs no introduction as an author. He has contributed to our publication and he is the author of our Bulletin #45—the Virginia & Truckee R. R. In addition to this, he was the technical director of "Railroads on Parade" at the New York World's Fair, an office that involved the humoring and petting of several temperamental old time locomotives for their daily performance and lastly, he has a genuine love for the little "old timer" and the road it served.

"Bonanza Railroads" is a history of five small western railroads—Sacramento Valley; San Francisco & San Jose; Virginia & Truckee; Eureka & Palisade and Nevada Central companies. All were built for a specific purpose and some, having fulfilled that purpose are no more. The author has done more than merely recite the birth, rise and decline of these little roads—he has mixed with his recital the colorful life of the mining west and has more than succeeded in making an interesting history.

In addition to many interesting and valuable photographs are the drawings of Arthur Lites, beautifully rendered so as to catch the spirit of these early railroads. Inside the covers will be found a map embracing that portion of California and Nevada that included these five railroads—of inestimable value in placing these roads. Lastly, for the "locomotive fan" will be found a complete roster of the locomotives and their disposition that saw service on the "Bonanza Railroads."

To gather all of the details of these five little railroads has been no small task, a task that would be increasingly difficult as time passes. Thanks to the author their history has been preserved and in a fashion that we can strongly commend to our members.

"THE RAILWAYS OF PERSIA," reprinted from "The Railway Gazette," October 3, 1941. 12 pages, illustrated, price 2 shillings. Copies may be obtained at 33, Tothill Street, Westminster, London, S. W. 1, England.

This is a study and a description of the Persian railways that have been completed, that are building or are projected. To aid the student are three maps in which all of these projects are included and 19 illustrations that tell better than anything else the roughness of the terrain through which the lines are built.

Save for a short line from the Caspian Sea southwards and an extension of the five foot gauge Russian system extending into the Tabriz area, no railway was built in this territory until 1927. One line connects the Caspian Sea with the Persian Gulf via Teheran and lines have been built from Teheran towards the east and towards the west.

The illustrations, together with the text, make an interesting story of railroad building under difficult conditions in a land that has been pretty much secluded until recently. The work has been most carefully prepared and will be gladly added to the store of world's railways.

"THE CIVIL WAR CAREER OF THOMAS A. SCOTT," by Samuel Richey Kamm, 208 pages, 9x6, bound in paper. Published by the University of Pennsylvania. Copies may be procured from the author at Wheaton College, Wheaton, Illinois, price $2.50.

This thesis was presented by the author for his doctor's degree. In spite of his consultation of sources, the archives of the Pennsylvania R. R., the Commonwealth of the same name and our War Department, he has produced a very well written narrative.

"Tom" Scott was made Vice President of the Pennsylvania R. R. at the age of 36. He was a great friend of Simon Cameron, Secretary of War under Lincoln and Gov. Curtain of Pennsylvania. On Scott devolved the transportation of troops, first through Baltimore, strongly sympathetic with the South, later around Baltimore by means of Perryville and Annapolis, Maryland. His promptness after first Bull Run probably save the capital.

Appointed Assistant Secretary of War under Cameron, he helped reorganize the War Department which was badly in need of an organization with the huge task that confronted it. Cameron was succeeded

by Stanton and under the latter he became the eyes and ears of the War Department in the West. He uncovered fraud and corruption in the procurement of supplies and getting the men to destination. On June 1, 1862, he resigned his position, returned to Pennsylvania with his road and did much to defend that state from the threatened invasion from the south.

Perhaps his biggest task lay in the transportation of 23,000 troops, with their horses, guns and baggage, for the relief of Rosecrans after the defeat of Chickamaugua. The route was from Bristow, Va., to Stevenson, Ala., 1,233 miles. The roads were of different gauge, pontoon bridges had to be built or ferry service had to be arranged at certain points. Despite all this, the huge task was completed in 11½ days, 3½ days less than the lowest estimate and 2½ months under the expectations of Gen. Halleck. For this work, D. C. McCallum of the U. S. Military Railroads, Messrs. Garrett and Smith of the Baltimore & Ohio were responsible in the East and Scott from Louisville southwards.

Scott never escaped the odium of his methods used in the repeal of the tonnage tax in his native state. His tariff for the transportation of troops was misunderstood by the Quartermaster's Department. Despite these, no one can deny that his ability as a transportation expert and his hard labors were the means of saving the North in a very critical time. The military officers learned of the necessity of speed in the movement of troops, then as now, and at that time the railroad was the only means that offered that. Lastly, the War Department and the military leaders learned that a capable railroad man was far superior to furnish the equipment and handle such a movement than their own officers. The task of moving 23,000 men in 1863, with all its many difficulties, still ranks as a piece of efficient planning and handling of details.

The author has produced a most interesting thesis and one that every railroad man or student of railroad history should take pride in reading.

In Memory Of

Col. Bion J. Arnold
Annual Member
231 South LaSalle Street, Chicago, Illinois,
who died on January 29, 1942.

M. W. Jones
Annual Member
1105 B. & O. R. R. Bldg., Baltimore, Md.
who died on February 1, 1942.

Prof. Edward C. Schmidt
Annual Member
1 University Place, New York, N. Y.
who died on March 21, 1942.

Dr. Howard K. Shrom
Annual Member
240 Main Street,
Imlay City, Michigan,
who died on March 13, 1942.

R. A. Sperry
Annual Member
236-516 West Jackson Bldg., Chicago, Illinois,
who died on May 15, 1941.

W. H. Winterrowd
Life Member
Vice President, Baldwin Locomotive Works,
Philadelphia, Pennsylvania,
who died on December 7, 1941.